OPERATIVE SURGERY

COVERING

THE OPERATIVE TECHNIC INVOLVED IN THE OPERATIONS OF GENERAL AND SPECIAL SURGERY

By

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CONTAINING 6378 ILLUSTRATIONS
MANY IN COLORS

VOLUME V

PHILADELPHIA AND LONDON

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SURGICAL ANATOMY OF THE COLO-RECTO-ANAL TRACT

See Surgical Anatomy of the Intestines, in General, Vol. IV, pp. 611–618.

GENERAL SURGICAL CONSIDERATIONS IN OPERATING UPON THE COLO-RECTO-ANAL TRACT

See General Surgical Considerations in Operating Upon the Intestines, in General, Vol. IV, pp. 620–629.

COLOTOMY

Incision of the colon corresponds with enterotomy, or incision of the small intestine (duodenotomy, jejunotomy, or ileotomy) – which has been described (Vol. IV, pp. 630–632).

Colotomy is rarely undertaken for the removal of objects from the colon – and, sometimes, for the temporary relief of distention. When undertaken for the latter purpose, a small axial incision is made into the free aspect of the colon, preferably through one of the longitudinal muscular bands, and into this is slipped a flanged glass tube, of the Paul or Mixter type, to the outer end of which a piece of rubber tube has been attached. The purse-string suture which has been previously placed in the wall of the intestine is then tied outside of the flange of the tube. In this way the contents of the large intestine, semifluid or gaseous, can be evacuated at a distance from the patient. At the end of the operation the purse-string suture is cut, the tube withdrawn, and the opening in the colon closed by marginal sutures reinforced by Lembert stitches. The technic is shown in Vol. IV, p. 3808.

COLOSTOMY, IN GENERAL

Description.—Colostomy signifies the establishment of an artificial opening, either temporary (fecal fistula) or more or less permanent (artificial anus), of some part of the colon, upon the skin. It corresponds, in the large intestine, with enterostomy, in the small – with which, in general principle, it has much in common – see Vol. IV, p. 651, which should be read in this connection. Cecostomy has also been described (Vol. IV, p. 809) – as well as appendicostomy (Vol. IV, p. 781). Where the colostomy is meant to be temporary, no attempt is made to form a spur in the construction of the opening, whereas, in forming a more or less permanent colostomy, a pronounced spur formation is sought. Formerly it was much more common to first anchor the loop of colon, and not incise it until adhesions were firm (if the patient's condition admitted delay). At present, however, colostomy has been rendered far more useful by the introduction of flanged glass tubes, with rubber-tube attachments, which can be tied into the loop of the intestine, or into each limb of the loop, at the time of the operation, thus enabling the colon to be opened immediately, for the relief of the symptoms, and without soiling the field, or the wound, during the period in which adhesions are forming to shut off the peritoneal cavity. Where both limbs of the colonic loop are brought into the wound a marked spur is, necessarily, formed. When a pronounced spur is not desired only the outward convexity of the intestinal loop is anchored in the wound. When a marked spur is sought the loop is drawn well out of the wound. And when no tube or tubes are used, and it be possible to delay, the opening is often deferred until adhesions form – as was the rule formerly. If tubes be used, and no spur is desired, a single tube is tied into the loop which only partly projects from the wound – but where a definite spur is expected to remain, the loop is usually divided completely, and a tube tied into each limb of the bowel.

Indications for Colostomy.—(*a*) To form a permanent artificial anus, above the site of some obstruction in the bowel below (usually malignancy of the colon or rectum) – in connection with or independently of removing the pathologic condition below, – (*b*) To form a temporary vent, and give relief, prior to some more radical operation upon the bowel below, – (*c*) To furnish temporary relief in some types of colitis, or rectitis, or to afford an avenue of local treatment, – (*d*) In conditions of stricture, or ulceration of the bowel below, – (*e*) In fistulæ between the bladder and the bowel, – (*f*) In some congenital deformities interfering with the normal outlet of the bowel, – (*g*) In some forms of obstruction of the large intestine other than those due to malignancy, such as may be caused by kinks, bands, and the like.

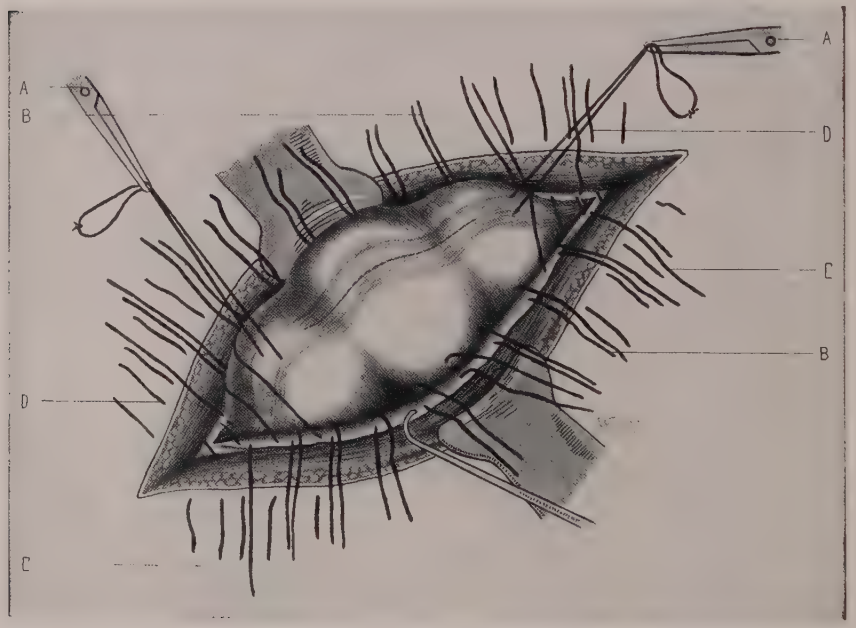


Fig. 4034.—Left Inguinal Colostomy for Temporary Fecal Fistula: – A, A, Temporary ligatures drawing sigmoid flexure of colon into wound; – B, B, sutures uniting peritoneum and lower part of muscular wall of wound, to serous and muscular coats of intestine; – C, C, sutures passing through peritoneum and lower part of muscular wall, on one side; serous and muscular coats of intestine, in center; and peritoneum and lower part of muscular wall, on opposite side; – D, D, sutures passing through entire thickness of muscular wall. Position of future axial incision in colon is shown by dotted line.

Chief Varieties of Colostomy.—(*a*) Ascending colostomy, of the ascending colon, – (*b*) Transverse colostomy, of the transverse colon, – (*c*) Left inguinal, or iliac colostomy, – (*d*) Lumbar colostomy. In any of these forms the opening may be intended to be a temporary fecal fistula or a permanent artificial anus.

The chief features of and indications for these different forms of colostomy will be given under the individual operations. In general, it may be said that colostomy nearer the distal end of the large intestine is, naturally, preferable to colostomy nearer the proximal end – and that left inguinal colostomy is, unless, for some reason, especially contraindicated, the operation of choice. Lumbar colostomy was once quite often adopted, chiefly because it could usually be performed without opening the peritoneal cavity, at a period of

surgical development when such involvement was so often serious _ but is now so rarely performed as to be an almost discontinued operation.

The ability to open the intestine at once, through the use of glass tubes, _ the practical discontinuance of the lumbar operation _ the less frequent performance of the operation in two stages _ and the tendency to adopt forms of operation which seek to secure some degree of muscular control over the artificial bowel opening, are features which have come prominently to the front.

Where a temporary fecal fistula is sought, the loop is anchored into the abdominal wound superficially (that is, no marked protrusion is allowed) the bowel is incised axially _ and the formation of a spur is not encouraged.

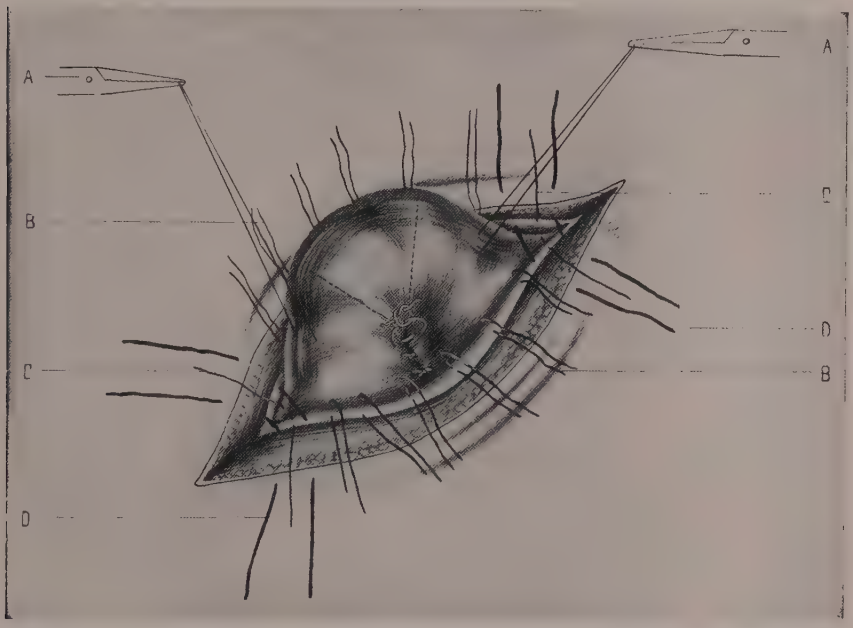


Fig. 4035.—Left Inguinal Colostomy for Permanent Artificial Anus: _ A, A, Temporary traction-ligatures drawing sigmoid flexure of colon into wound; _ B, B, sutures uniting peritoneum and lower part of muscular wall of wound, to serous and muscular coats of intestine; _ C, C, sutures passing through peritoneum and lower part of muscular wall, on one side; serous and muscular coats of intestine, in center; and peritoneum and lower part of muscular wall, on opposite side; _ D, D, sutures passing through entire thickness of muscular wall. Position of future excision of triangular piece of colon is shown by dotted lines.

Where a more or less permanent artificial anus is required, the loop of bowel is drawn well out of the wound _ the intestine is divided transversely, in large part, or entirely, or the tube may be tied in the knuckle of intestine, which is subsequently divided (according to circumstances, and the object desired) _ and spur formation is encouraged. The spur tends to mechanically prevent the contents of the proximal limb from passing on, in part, at least, into the distal limb _ serving to direct the flow outward.

By operating in the intramuscular manner hernia is less apt to follow _ and, additionally, greater sphincteric control is secured.

In right inguinal colostomy the fixity of the ascending colon does not lend itself to the formation of a spur _ so desirable in permanent artificial ani _ nor is the site, physiologically, so favorable for operation. The bowel opening should be as far from the ileum as possible, as a general rule.

Colostomy, in fine, must be considered as a palliative measure _ undertaken as a temporary measure for the relief of a removable condition (as in colitis) _ or as a permanent measure as the only available means of affording some help and comfort in an unremovable condition (as in malignancy).

A variety of mechanical devices have been made for controlling and catching the fecal outflow of fecal fistulæ and artificial ani.

The general features of contrast between temporary and permanent colostomies are seen in Figs. 4034 and 4035.

RIGHT INGUINAL, OR ASCENDING COLOSTOMY

Description.—This is an unusual procedure _ the same objections exist to it as have been given against cecostomy (Vol. IV, p. 809). When performed it is generally resorted to as a temporary fecal fistula, rather than as a more or

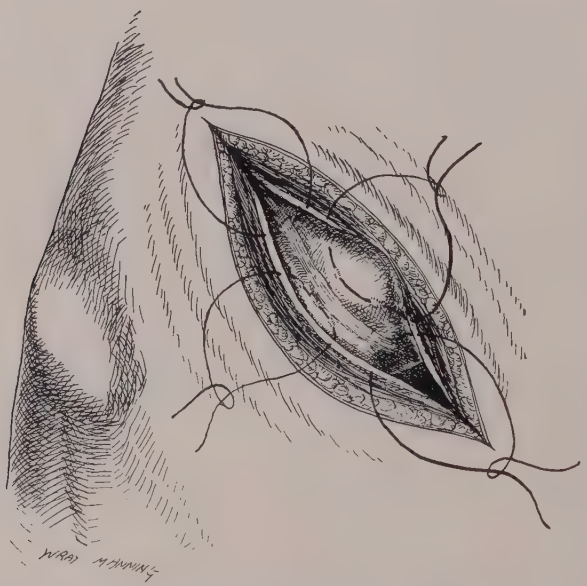


Fig. 4036.—Temporary Right Inguinal Colostomy: _ The peritoneum is approximated and sutured to the serosa of the intestine _ as the loop of the colon lies in the lower plane of the wound, not protruding beyond the surface.

less permanent artificial anus. In the case of an obstruction of the transverse colon, however, there would be no alternative but to open the large intestine proximally to the obstruction.

Operation.—The general features of the operation are the same as those for left inguinal colostomy (v. p. 8), the more usual operation _ and, therefore, will not be here given in detail. Owing to the relative immobility which usually but not invariably exists the delivery of a loop of ascending colon is generally impossible _ the procedure usually amounting to a lateral colostomy _ that is, the loop of bowel can often be only brought forward far enough to just present in the wound rather than protrude through it.

In those cases where it is necessary to bring the ascending colon further forward and there is not sufficient play to accomplish this (although the bowel may, exceptionally, have a mesentery), it may be sufficiently mobilized, unless some pathologic condition prevent, by incising the peritoneal reflection

along its outer aspect as it passes from the colon to the abdominal parietes _ and then hooking the finger beneath the colon and drawing it sufficiently far forward.

The ascending colon may be exposed by either the intramuscular or transmuscular method _ as in left inguinal colostomy. These incisions are shown in Vol. IV, p. 786. Where it is not imperative to open the bowel at once, time is given the anchorage to form adhesions _ after which the colon is incised. If it must be opened at once, a flanged glass tube, with rubber-tube attachment, is tied in the presenting portion of the colon, through an incision made within an area previously surrounded by a purse-string suture for tying in the drain. The shallow, non-protruding way in which the bowel is anchored in the wound is seen in Fig. 4036.

Note.—No attempt is made to cover the many technical details of colostomy either in connection with ascending colostomy or transverse colostomy _ because of their being given at such length under the kindred operation so much more frequently performed left inguinal colostomy (p. 8).

TRANSVERSE COLOSTOMY

Description.—The making of a colostomy in the transverse colon occupies somewhat of a midposition _ being on general principle more desirable than a right inguinal colostomy, and less desirable than a left inguinal colostomy _ though, like right inguinal colostomy, it is an unusual operation, and must, generally, have some special reason for its justification _ such, for instance, as when a left inguinal colostomy is impossible, or where it is used as a temporary procedure, preliminarily to operating upon the pelvic colon _ or, again, where an unusually short mesosigmoid makes it difficult to bring out a satisfactory loop of the sigmoid colon for the more usual left inguinal colostomy.

On the other hand, there has been, of late, a noticeable move, in some quarters, to place this technic upon a better recognized ground, as a desirable routine in many cases, McGavin bringing forth the following features in its favor: _ A complete colostomy may be performed, because an entire loop of the transverse colon can be brought out, owing to the length of mesentery usually present, _ An artificial anus placed nearer the center of the body admits of easier emptying of it by the patient's leaning forward, and his easier care of it, _ For the same reason, and also because of the absence of such bony prominences as the iliac crests, and the anterior superior iliac spine, and the presence of lineæ transverse and the costal arch, retentive apparatus to catch feces is more readily kept in position, _ The bringing of the loop through the split rectus muscle affords a certain degree of muscle control over the bowel movements, _ The bowel movements are somewhat less offensive than those which escape from the left inguinal colostomy, _ And, where the opening is meant to be temporary, it is comparatively easily closed.

Operation.—The incision of approach is generally a vertical one, placed midway between the median line and the outer border of the rectus muscle (right or left, according to the position desired for the opening) _ the greater part of the incision lying above the umbilicus. The anterior sheath of the rectus is incised and the underlying muscles split in its line of cleavage, after which the posterior layer of the rectal sheath, subserous areolar tissue, and peritoneum are divided _ and the abdomen entered. The rest of the operation is accomplished just as in left inguinal colostomy (p. 8). Some slight modification in the technic is called for in connection with the great omentum _ which may make the delivery of the loop of the transverse colon difficult, cause some difficulty in the fixation of the loop, and require a larger abdominal

opening. These added inconveniences may be overcome by severing the attachment of the great omentum to the transverse colon to the necessary extent. When the loop of the transverse colon is brought out, its proximal and distal limbs will run transversely _ and not vertically, as in the case of either the right or left inguinal colostomy.

Note.—The technical details of manipulation are sufficiently covered under Left Inguinal Colostomy, p. 8.

LEFT INGUINAL COLOSTOMY, OR SIGMOID COLOSTOMY

BY THE INTRAMUSCULAR, "GRID-IRON" INCISION

Description.—Left inguinal colostomy (iliac colostomy, anterior colostomy, operation of Littré, as it is variously called) consists in making a more or less permanent opening in the sigmoid flexure of the colon, in the left iliac region, through the peritoneal cavity. The manner of suturing the intestine to the abdominal wall will differ, dependent upon whether a temporary fecal fistula or a permanent artificial anus be sought. Also the final steps of the operation will differ, dependent upon whether the bowel is to be opened at once, or whether the operation is to be performed in two stages and the bowel opened in three or four days, after adhesions have formed and the peritoneal cavity is shut off _ and also as to whether the opening is to be temporary or permanent. Colostomy is generally performed upon the left side _ though it may be done upon the right _ the steps being largely the same in either case.

The operation may be performed by an intramuscular method of approach, thus seeking to secure some degree of muscular control over the bowel movements _ or by free, open incision, as originally practised _ the former being much more desirable.

The introduction of the Paul flanged glass tube, to which a rubber tube is attached to conduct away the feces, has largely added to the value of the technic _ thereby making it possible to complete the operation at the first sitting rather than to wait for adhesions before opening the bowel. In the following account the operation will be described as carried out where such tubes are available for use, as well as where the older technics are employed. Following the fundamental description of the operation, several modifications of technic will be mentioned.

In favor of left inguinal colostomy, over left lumbar colostomy, its former rival, are the following: _ The artificial anus is more conveniently placed; _ the operation is both easier and quicker; _ the position for anesthesia is better; _ the wound is not so deep; _ there is no chance of failing because of the presence of a mesentery (which sometimes interferes, by its presence, with the operation posteriorly); _ the exploration of the abdomen is possible; _ the shallow wound makes the formation of a spur, or any other indicated step, easier.

Preparation _ Position.—As for median abdominal section.

Landmarks.—Umbilicus; left anterior superior iliac spine; Poupart's ligament.

Incision.—About 7 to 10 cm. (3 4 inches) long _ crossing, at right angles, an imaginary line from the umbilicus to the left anterior superior iliac spine, at a point about 4 cm. ($1\frac{1}{2}$ inches) internal to the iliac spine, the center of incision being upon this imaginary line. The incision will, therefore, be about parallel with Poupart's ligament and with the fibers of the external oblique. This incision corresponds with McBurney's incision for appendicectomy, except that it is upon the left (see Fig. 4001, D, Vol. IV, and Fig. 4037).

Operation.—Up to the opening into the peritoneal cavity the steps are

practically the same as in McBurney's intramuscular operation for the removal of the appendix (Vol. IV, p. 785). Incise the skin and fascia in the above line, clamping the bleeding vessels. Separate and retract the fibers of the aponeurosis of the external oblique in the line of their cleavage. Separate and retract the fibers of the internal oblique in their cleavage. Similarly separate and retract, intramuscularly, the fibers of the transversalis. Divide the transversalis fascia and subperitoneal connective tissue in the line of separation of the transversalis muscle for about 4 to 5 cm. ($1\frac{1}{2}$–2 inches). While holding the parts apart replace the retractors which have retracted the several tissues in their cleavage line by two retractors, if more convenient _ drawing the lips of the wound asunder in the two most convenient directions. Introduce the right index-finger into the peritoneal cavity toward the left iliac

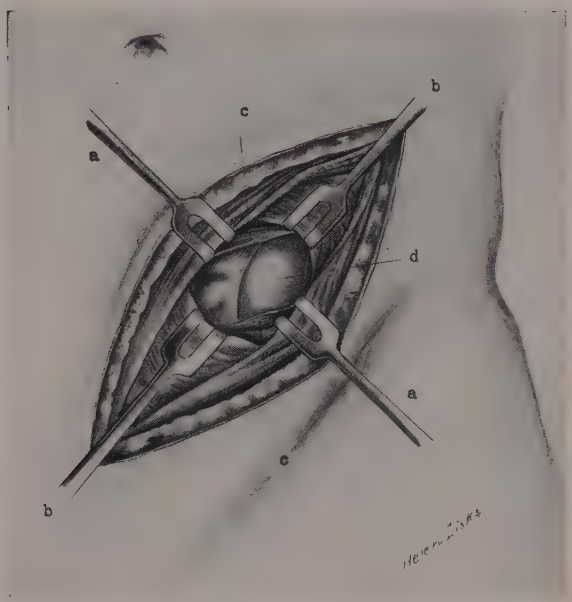


Fig. 4037.—Left Intramuscular ("Grid-iron") Inguinal Colostomy for Either Fecal Fistula or Artificial Anus _ I: _ a, a, Tractors of split external rectus; _ b, b, tractors of split internal oblique; _ c, c, split transversalis. The sigmoid colon, d, is found after dividing the subserous areolar tissue and peritoneum.

fossa _ entering at the outer angle and passing downward and toward the median line, with the finger held in a hook-like fashion _ hooking up the sigmoid flexure of the colon and bringing it out into the wound _ recognizing it by its appendices epiploicæ, its sacculations, and its longitudinal bands (Fig. 4038). After drawing the loop well out by finger or intestinal forceps, return into the lower angle of the wound all the excess drawn out of the upper angle until checked by the mesocolon _ thus assuring that there will be no downward sagging of the intestine from above, with consequent tendency to hernia of the proximal gut through the artificial opening (Harrison Cripps). The steps of the operation from this point onward will depend upon _ (*a*) Whether a temporary fecal fistula is intended, _ (*b*) Or a permanent artificial anus, _ (*c*) And whether the colonic opening may be delayed, _ (*d*) Or must be made immediately.

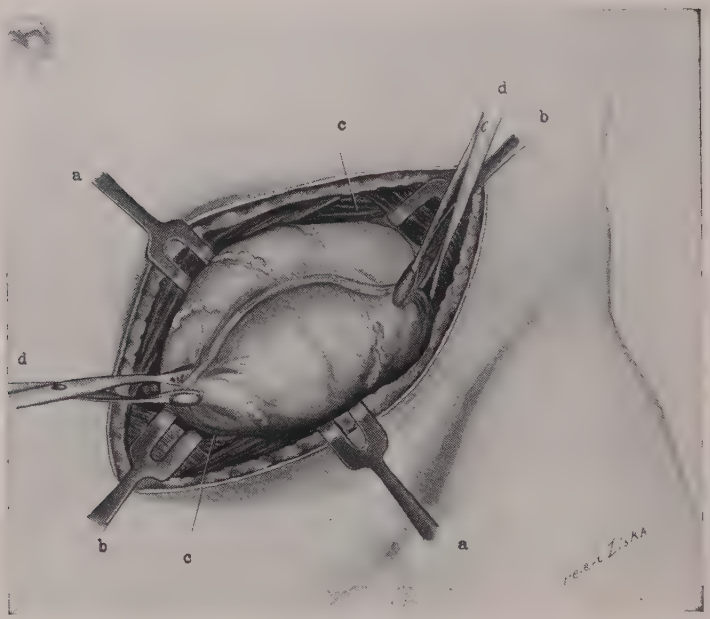


Fig. 4038.—The Same _ II: _ a, a, Retractors of external oblique; _ b, b, retractors of internal oblique; _ c, c, transversalis separated; _ d, d, intestinal forceps grasping the longitudinal band of the sigmoid and lifting a loop of the large intestine out

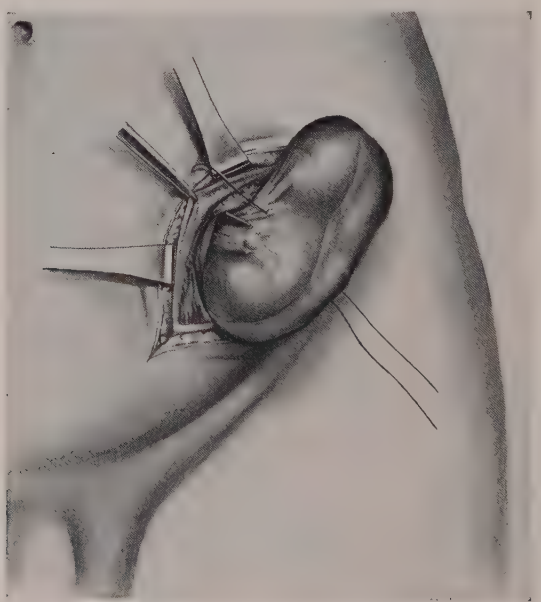


Fig. 4039.—Left Intramuscular Inguinal Colostomy; _ The sigmoid flexure of the colon is brought through the regular "grid-iron" incision. It is here seen emerging between the split fibers of the external oblique, internal oblique, and transversalis _ resting against the margin of the unopened rectal sheath, upon its inner aspect. It is being anchored, primarily, by a single stitch passing through all the thicknesses of both margins of the abdominal wound, and the mesocolon, after the fashion of Taylor's technic.

(*A*) Anchorage of the Colon where a Temporary Fecal Fistula is Intended: — In this case the presenting convexity alone (representing from one-half to three-quarters of the circumference of the intestinal tube) is sutured into the wound, the convexity of the gut being held, during suturing, into contact with the wound by two silk traction-sutures passed through the serous and muscular coats, preferably through the superior longitudinal band of the colon — (or this aspect of the intestine may be gently grasped with forceps). (See Fig. 4039.) Continuous or interrupted silk or chromic gut sutures are now passed through the serous and muscular coats of the intestine, on the one hand, and the peritoneum, transversalis fascia, and lower muscle tissue of the abdominal wound, on the other — passing sufficiently far from the free edge of the perito-



Figs. 4040 and 4041.—Sectional View of Fecal Fistula and Artificial Anus Shown in Comparison: — **a**, Fecal fistula, the intestinal loop being sutured into the lower plane of the abdominal wound, not protruding above the skin level; — **b**, artificial anus, the intestinal loop being drawn well out of the wound and so sutured that it protrudes considerably above the skin level — with mesenteric aspects of the two limbs of the loop so approximated as to insure a substantial spur. The same technic as in **b**, but with the mesenteric aspects of the two limbs sutured together, may be carried out, to further emphasize the spur formation.

neum so that some width of peritoneum will be approximated to the gut — thus bringing serous surfaces into contact. Preferably the lower line of sutures is passed through the lower longitudinal band — and the upper line, near the mesentery. Any excess of abdominal wound is closed from either end by interrupted sutures, placed before or after anchoring the loop, as more convenient, and passed as in abdominal section. The less the amount of intestinal loop brought into the wound, and the lower the plane of the abdominal wound into which it is stitched, the less will be the difficulty in eventually closing the artificial opening, even if such an opening does not finally close of its own accord (Fig. 4040, a).

(*B*) Anchorage of the Colon where a Permanent Artificial Anus is Intended:

— The loop of the colon is here drawn well out of the wound — sufficiently far to expose its mesentery (Fig. 4041, **b**). In order to make the spur more pronounced, the two limbs of the loop may be sutured together with two or three catgut sutures, passing through the outer coats only, on each side of the mesentery. The mesenteric aspects of the intestinal limbs are thus held together, thereby forming a substantial spur. Having first closed in any excess of the abdominal wound, from either end, by sutures applied as in abdominal section — unless this can be more conveniently accomplished after anchorage — the protruding loop of intestine is then sutured into the wound by chromic catgut sutures, which pass through the serous and muscular coats of the

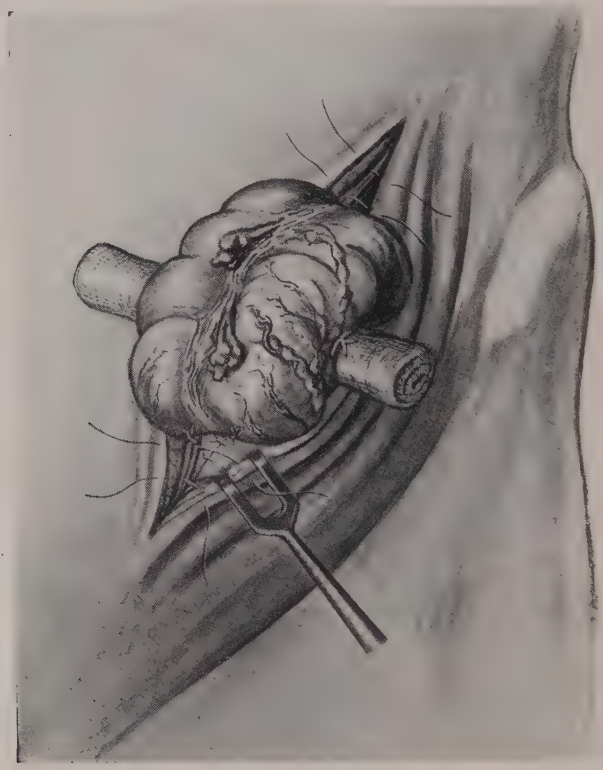


Fig. 4042.—Left Inguinal Intramuscular Colostomy for Artificial Anus; — The knuckle of descending colon has been delivered — its mesentery pierced by a roll of tightly wound gauze, covered with rubber tissue, bridging the wound, upon which roll the intestinal coil rests. Its serosa is sutured to the parietal peritoneum — which is closed up to contact with the intestine. The ends of the wound are sutured.

colon, on the one hand, and through the peritoneum, transversalis fascia, and lower plane of the abdominal wound, on the other. In addition to the simple and original method just described, of anchoring a prominent loop of the colon in the abdominal wound, various methods of accomplishing this — some by artificial means, such as passing a glass rod or a roll of gauze through the mesentery, beneath the loop (Fig. 4042) — others, by methods of simple suturing — have been devised, and are preferable, in some of the methods, to that above described. These will be further explained and illustrated in some of the following special forms of colostomy. The sectional view of colostomy for artificial anus has been shown in Fig. 4041, **b**.

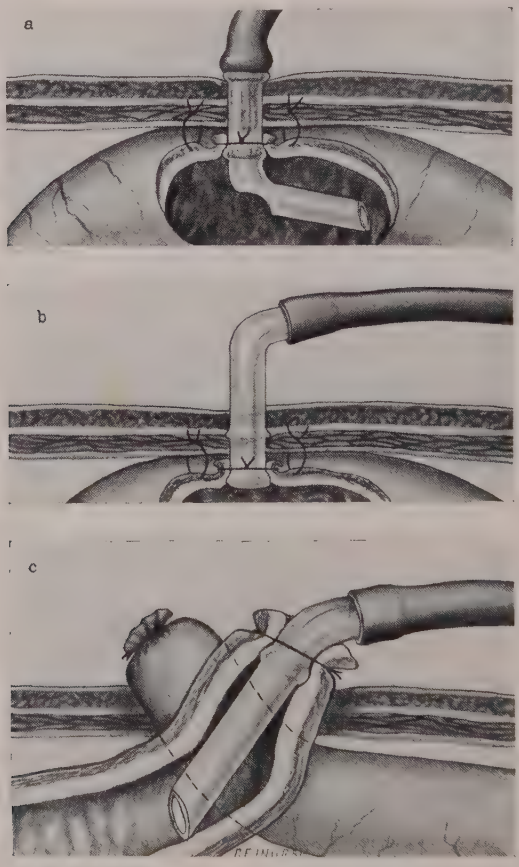
(*C*) Where the Opening of a Temporary Fecal Fistula may be Delayed: – If haste be unnecessary, the opening is made in two or three days, when the serous surfaces have united. Even a very few hours will secure some degree of adhesion, which is usually sufficient to protect the peritoneal cavity from soiling, provided great care be exercised in opening the bowel, not to detach such frail adhesions. The incision into the colon for temporary fistula should always be made axially – as subsequent healing is thereby made much easier. An incision of about 2 cm. ($\frac{3}{4}$ inch) is made in the long axis of the colon. The margins of the intestinal opening are then sutured into the lower stratum of the wound – the suture including all the coats of the bowel, on the one hand, and the peritoneum, transversalis fascia, and some of the muscle tissue of the lower stratum of the wound. The method just described was the one formerly always employed in delayed opening, and is still often used. But the opening, even if delayed, may also be made by means of incising the intestine within a previously placed purse-string suture, and then tying in a flanged glass tube, with rubber-tube attachment, just as is described where immediate opening is performed – and this should always be done if there be any question as to possible leakage into the peritoneal cavity, when the opening is made in some intermediate period, where there is uncertainty as to the strength of adhesions.

(*D*) Where the Opening of a Permanent Artificial Anus may be Delayed: – If there be no need to open the colon immediately, delay for two or three days until adhesions have shut off the peritoneal cavity. The nature of the opening, when finally made, will depend upon what is sought. (*a*) If an opening of considerable duration, but not absolutely permanent, be planned, then the colon should not be divided entirely through. Such an opening may be made in one of two ways, – An oval-shaped piece may be excised from the convexity of the protruding colonic loop, which will include one-half or three-quarters of its entire circumference, – Or, somewhat better, a wedge-shaped piece may be excised with scissors from the convexity of the protruding colonic loop, representing one-half or three-quarters of the circumference, but not passing all the way to the mesentery (v. Fig. 4035). If one of these methods be followed, the subsequent restoration of the intestinal canal will be very much easier. The margins of the colonic opening, resulting from either of the above methods, are then sutured into the borders of the abdominal wound – nearer the skin level than in temporary fecal fistula, but, as a rule (not invariably adhered to), not to the skin, as in an absolutely permanent artificial anus. (*b*) If it be planned that the colonic opening be a permanent artificial anus, then the colonic loop is divided completely through its circumference, and into the mesentery at the apex of the loop. The margins of both of the colonic openings are now usually sutured to the skin of the abdominal wound, where it is intended to use both openings. If no further use be required of the distal limb, its opening may be closed by suture, reinforced by Lemberts or a purse-string and dropped back into the abdominal cavity (as far as adhesions which have formed will allow).

As in the case of delayed opening in a temporary fistula, so the delayed opening in artificial anus may also be made by means of flanged glass tubes – by, after dividing the loop, tying a glass drain in the proximal loop, and closing the distal loop – or by tying a glass drain into both proximal and distal ends – just as described where immediate opening is performed (v. i.) – and here, as in temporary fistula, this should always be done, if there be any reasonable question as to possible leakage into the abdominal cavity, when the opening is made in some period of uncertainty as to adhesions.

(*E*) Where an Immediate Opening of the Colon is Required in Temporary Fecal Fistula: – The usage of flanged glass drains, with rubber-tube attachment, is the method of choice in all immediate openings in colostomy opera-

tions – both serving to protect the abdominal cavity from fecal soiling – and conveniently conducting the fecal discharge to some receptacle at a distance from the patient. Several types of flanged, angular glass drains are employed in temporary fecal fistulæ – the one of most usual type (Fig. 4044, b) only passes a limited way into the bowel, and the bowel opening is tied between the two ridges of the flange, so that it slips neither out nor further in (which might block intestinal flow). The other type has a longer inner limb beyond



Figs. 4043–4045.—Sectional Views of Flanged Glass Tubes, with Rubber Tube Connections, Employed in Cases of Temporary and Permanent Fecal Fistulæ: – a, Fenestrated, angular drain, passing deeply into the bowel; – b, plain, angular drain, entering the bowel just over its collar; – c, proximal and distal ends of the divided bowel, slightly crossed, have been brought out of the abdominal wound – with a curved glass drain in the proximal end. They usually make their exit side by side.

the angle and the two ridges of the flange, and its especial feature is a fenestrum in the elbow preventing intestinal blockage (Fig. 4043, a).

In introducing the glass drain in cases of temporary fistula, although the loop of bowel is to eventually occupy the lower plane of the abdominal wound, it is much easier to incise the colon and tie in the drain, as well as infinitely easier to prevent soiling the peritoneal cavity, if the loop of intestine be first drawn well out of the cavity, being everywhere packed off with gauze, and the knuckle of bowel itself clamped, proximally and distally. The best plan

is to place an enveloping purse-string suture of silk or linen through the outer coats only, and in elliptic or circular outline. Within this area a stab-cut is made through all the walls of the intestine _ the outflow caught on gauze _ the glass drain introduced _ and the purse-string tightened and tied. In addition, a coarser silk or linen ligature should be tied over the purse-string, which, alone, is usually not strong enough. The intestinal margins are drawn up around the tube with forceps during the tying of the purse-string and the ligature. If a cork has been placed in the distal end of the rubber tube attached to the glass drain, for immediate control, during operation only, no leakage will occur. The colonic loop is then allowed to sink back into the prearranged level of the abdominal wound which it has been planned it shall occupy _ and there stitched in position as already described. If, on the other

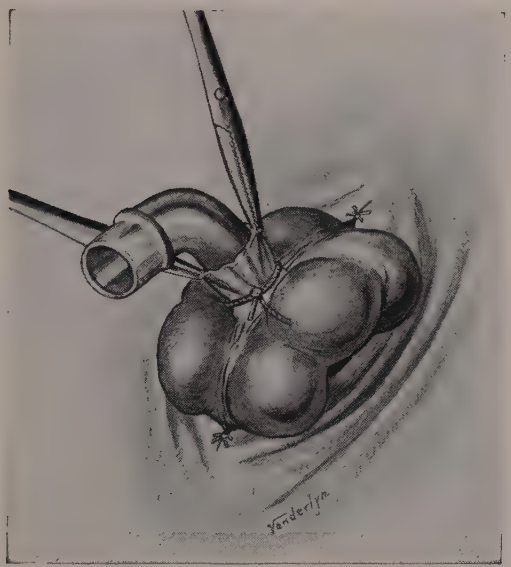


Fig. 4046.—Glass Tube Drainage, Where an Immediate Opening is Required in Temporary Fecal Fistula; _ The tube being inserted while the colonic loop is out of the abdomen, after which the loop is sunken into position and sutured into the lower plane of the wound. The attached rubber tube is not shown here.

The picture also serves as an illustration of the Insertion of a Single Glass Drain Into the Convexity of the Colonic Loop, as an Initial Measure in Emergency _ in Permanent Artificial Anus Requiring Immediate Opening _ the loop here *remaining* outside of the abdomen.

hand, the colon has been already sutured into position, so that only its convex aspect presents in the lower stratum of the wound, the placing of the purse-string, the incision of the bowel, and tying in of the drain, will be somewhat more difficult _ but, on the other hand, if this be done two or three days after the first step of the operation, adhesions will have shut off the general cavity, so that danger from leakage, although this may occur to some extent, will be minimized.

(*F*) Where an Immediate Opening of the Colon is Required in Permanent Artificial Anus: _ This is the special field for the exploitation of the combination flanged glass drain, with attached rubber tube. Both limbs of the protruding loop of colon are prominently in the field, and lend themselves to the necessary manipulation. While the form of glass drain here employed may be angulated either inside of, or outside of the site, between the ridges, around

which the lips of the intestinal opening are tied, sometimes a perfectly straight flanged drain is employed, or a curved one. These glass drains may be used in only the proximal limb of the colon _ or in both proximal and distal limbs _ as shown in Fig. 4050 _ or in the convexity of the loop. Several methods of employing these glass drains are in vogue _ the chief of which are the following:

(*a*) Insertion of a single glass drain into the convexity of the colonic loop, as an initial measure in emergency: _ It will sometimes happen in an emergency operation, or in cases where the patient's condition is too bad for anything but the most absolutely necessary technic, that all that can be done, at the immediate moment, is to provide for fecal drainage. This may be quickly accomplished, after the anchorage of the colonic loop in the wound, by simply incising the convexity of the anchored knuckle of bowel and tying in a single

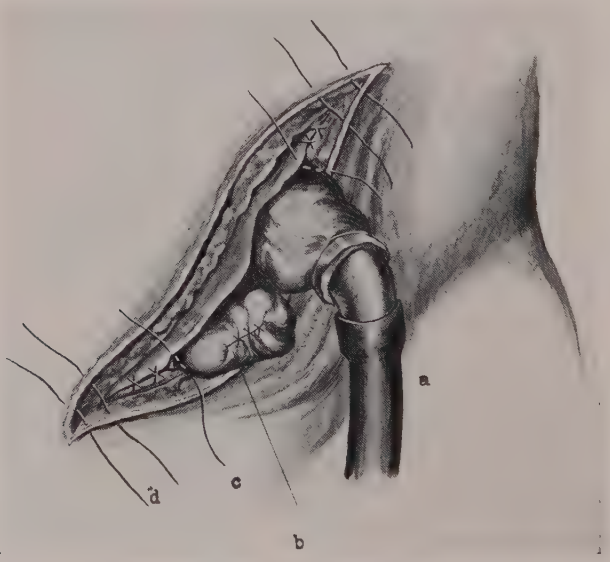


Fig. 4047.—Insertion of a Single Glass Drain Into the Proximal Limb of the Colonic Loop, with Closure of the Distal Limb and Its Return to the Abdomen: _ **a,** Proximal end of the sigmoid, tied around the Paul angular glass tube, with rubber tube connected to the opposite end; _ **b,** distal end of sigmoid closed by double tier of sutures and anchored into the lower end of the wound; _ **c,** muscle sutures; _ **d,** superficial sutures.

short, angular, flanged tube, which projects into neither proximal nor distal limb of the loop. This technic is illustrated in Fig. 4046, already cited in connection with the use of the glass drain in the immediate opening of a temporary fecal fistula, where, for that purpose, it represents the bowel loop *temporarily* drawn out for the insertion of the glass drain, after which it is to be *sunken back* and sutured into the lower plane of the abdominal wound. For the purpose now considered, however, it represents the loop of the intestine as it will *remain* sutured into the wound of a permanent artificial anus _ *protruding*. When the emergency is passed, and especially after adhesions have formed, the drain can be removed, and the colon divided _ and, at this stage, whatever might have been done, by choice, at the original operation, may now be carried out _ that is, the drain may be tied in the proximal limb, and the distal closed _ or a drain may be tied in both.

(*b*) Insertion of a single glass drain into the proximal limb of the colonic loop (Fig. 4047), with closure of the distal limb and its return to the abdomen: — This procedure presupposes indefinite permanency in the artificial anus of the proximal limb — and is chiefly resorted to in cases where, besides the fact that the proximal limb must have a permanent inguinal outlet, the distal limb is no longer needed for irrigation of the sigmoidal-to-anal outlets. After anchorage of the loop in the abdominal wound, and division of the colon, a Paul tube is tied into the proximal limb of the colon — and the opening of the end of the distal end is closed by a double tier of suturing, and dropped back into the abdominal cavity. The structures forming the margins of the abdominal wall are then sutured together about the proximal limb, with its attached

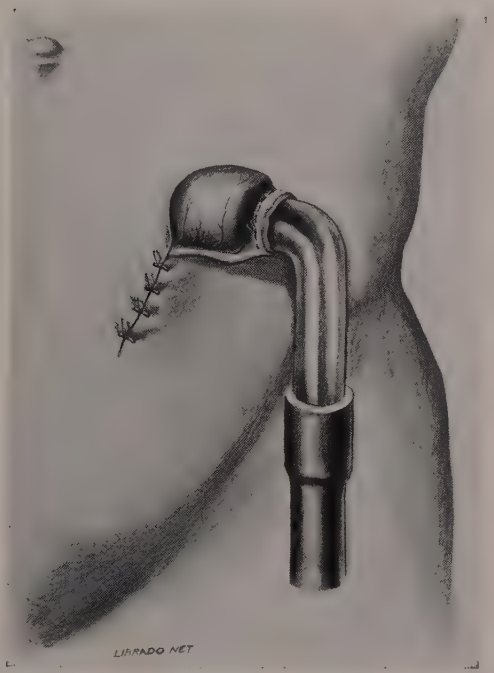


Fig. 4048.—Left Intramuscular Inguinal Colostomy, with Drainage by Paul Tube; — The distal limb of the colon has been closed, and dropped back into the pelvis — while the proximal limb, with attached glass and rubber drain, has been conducted between the split muscles — and out through the superficial wound.

drain, where they come through the upper aspect of the abdominal wound (Fig. 4048).

(*c*) Insertion of one glass drain into the proximal limb of the colonic loop, and another into the distal limb: — This method of procedure is usually adopted where a twofold condition simultaneously exists — the need for fecal drainage from the proximal limb, and the need for irrigation of the distal limb. While the technic is usually applied where the artificial anus is intended to be indefinitely permanent, yet, having control of both limbs of the loop, in their protrusion through the opening, makes it possible to restore the intestinal continuity, if that ever be indicated. The emergence of two such tubes between the split fibers of the external oblique muscle and aponeurosis is seen in Fig. 4049. The base of the two limbs of the loop has been anchored into the lower plane of the abdominal wound by chromic catgut sutures — and



Fig. 4049.—Left Intramuscular Inguinal Colostomy, with the Usage of the Paul, Tubes – in both the proximal and distal ends of the intestine – the latter being shown *in situ*. The proximal tube will be tied in.



Fig. 4050.—Intramuscular Inguinal Colostomy, Aided by Paul's Tubes; – The two segments forming the sigmoid loop have been separated and anchored: – a, Into the upper (proximal) limb of the loop, a Paul tube is tied for the evacuation of intestinal contents; – b, into the lower (distal) limb, a second Paul tube is tied, through which the lower intestine may be irrigated from the colostomy opening, to the anus – or, *vice versa*. The rubber tubing is attached to the glass tube before the insertion.

the muscle-aponeurosic skin planes will be closed around the exit of the tubes by sutures, the final appearance of the wound and emerging drains being seen in Fig. 4050.

In the usage of glass tube drains the intestinal ends generally loosen in from three to five days, and come away. If it seems desirable that they should

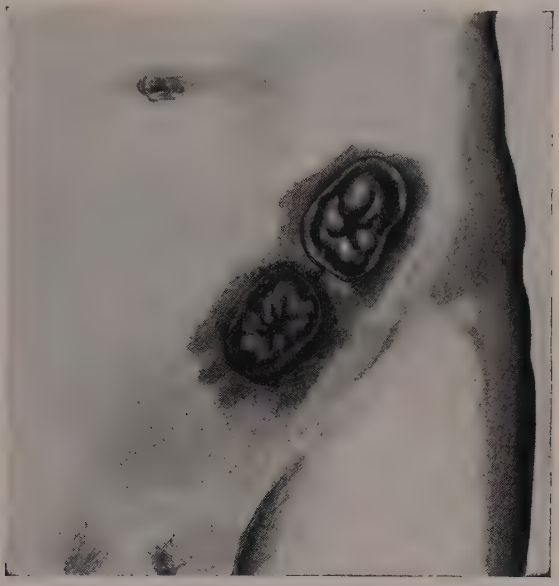


Fig. 4051.—The Final Appearance of the Intestinal Exits; – The opening of the proximal end of the sigmoid being more pronounced and protuberant – the lower opening of the distal end being less prominent and more sunken.

be retained longer, for some special reason – and provided the intestinal ends have not sloughed too extensively – they may often be retained a little longer



Fig. 4052.—Pomeroy Colostomy Belt and Bag; – Front view.

by retying the bowel around the drains. When the tubes first come away, an excess of intestinal ends, often more or less fringed and ragged, will generally be left. After these have been given time for reasonable shrinkage, they may

be evenly trimmed _ but so as to be a little excessive above the skin level. The final appearance of the protruding ends, at the end of about ten days, is as shown in Fig. 4051.

Various forms of mechanical means for controlling the outlet of the fecal fistula, or artificial anus, have been devised. They are usually supported

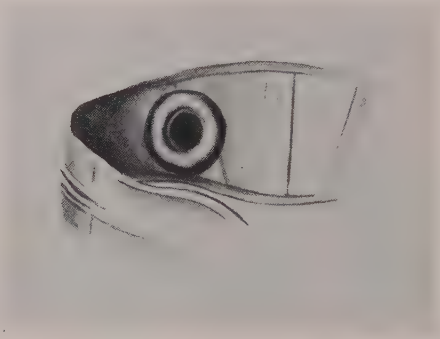


Fig. 4053.—The Same; _ Back view.

upon a belt _ and some are made simply to catch the feces as it comes away, at intervals, without undertaking to control the fecal flow _ Figs. 4052 and 4053 representing, respectively, the outer and inner aspects of this type of outfit. Other forms of apparatus undertake to more or less plug the outlet, endeavoring to control the flow during the intervals, and to only admit of its

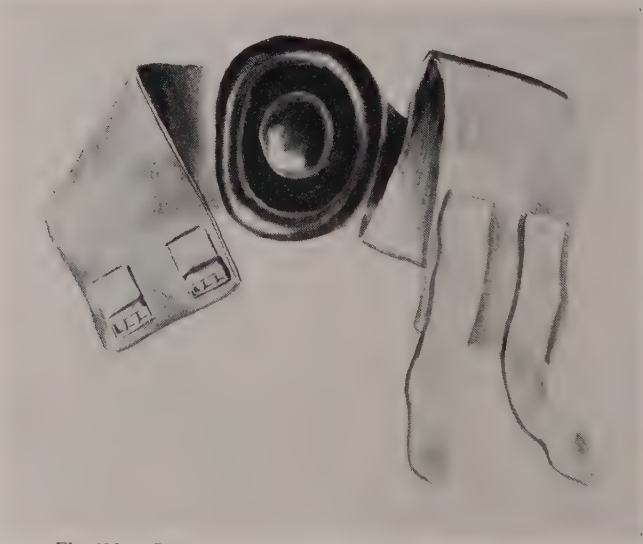


Fig. 4054.—Pneumatic Colostomy Belt. (Redrawn from Ball.)

outflow when the apparatus is removed _ such as the pneumatic pad shown in Fig. 4054 _ with a central pad to plug the opening _ and an outlying ring to hold within its encirclement whatever may escape past the plug.

Comments.—Right inguinal colostomy is but rarely practised. The contents of the ascending colon, from the nearness of the small intestine, are more liquid and less easily controlled, through fecal fistula, or artificial anus, even

by the intramuscular method. The absence, or shortness, of the mesentery also makes the attachment of the ascending colon to the abdominal wall more difficult. The operation upon the right side, therefore, is, practically, only performed either when the site of the trouble is uncertain, the cecum being, at the same time, distended – or when, in the course of a left inguinal colostomy, it is impossible to find the sigmoid colon (which must be exceedingly rare). When the operation is performed upon the right side, it is generally only a temporary fistula which is made, as, when this side is selected, it is generally an operation of emergency only.

A reasonably limited abdominal incision is desirable – as lessening the chance of hernia – though this had greater bearing in the former transmuscular than in the present intramuscular operation.

If the small intestine, mesentery, or omentum present during operation, they are pushed back into the abdomen.

If the sigmoid colon cannot be located during operation (which must be extremely rare), it can be found by having a nurse inject water through the rectum (if there be no obstruction) – a finger within the wound feeling the distending sigmoid.

In stitching the intestine into the wound, the stitching is so placed as to give the proximal part of the loop ample room (after disposing of its excess into the lower angle of the wound), and, at the same time, make pressure upon the distal part, to prevent the passage of intestinal contents into it – unless this be prevented by the special type of operation employed (such as the use of glass drains).

In some quarters, it has been recommended that the parietal peritoneum be drawn out and stitched to the margin of the skin around the wound, the muscle layers not being included – and that the intestine then be sutured to the parietal peritoneum. Although this method is advised in some of the latest works upon the subject, it seems to the author less desirable than anchoring both parietal peritoneum and intestinal loop into the lower plane of the abdominal wound, as described in the preceding text.

The part of the sigmoid colon usually selected for the colostomy is its most fixed part – after passing into the lower angle of the wound any excess at first drawn out – so that there will be no tendency of an upper, looser coil to herniate downward into the colonic opening (Harrison Cripps).

Sometimes the appendices epiploicæ are so marked and numerous as to call for removal after ligation.

Where artificial forms of support, passed through the mesentery, for the colonic loop to rest over, such as glass rods, are used, these are usually left in place for five or six days.

A short sigmoid mesentery may add to the difficulty of delivering a loop of the sigmoid colon. It may even be necessary to close the original wound, and perform a transverse colostomy (of the transverse colon) – if the transverse colon cannot be drawn into the wound already made for exposing the sigmoid colon.

The condition of some patients is so bad, in emergency operations, that the procedure must be carried out under analgesia – when only the simplest technic is warrantable.

If difficulty in locating the sigmoid colon be experienced, follow down the inner aspect of the abdominal wall, to the floor of the iliac fossa, and until the finger is arrested by the only fixed portion of the bowel in this region – the iliac colon – and this can be traced downward over the brim of the pelvis to the sigmoid colon – which is then drawn upward and outward into the wound. It is recognized by the teniæ, and by the appendices epiploicæ.

If the loop of sigmoid rest upon a glass rod bridging the wound, upon the skin level, sufficient further support of the loop is gotten from a single silkworm suture at each end of the wound _ passing through all the layers of the abdominal wall and through the serosa and muscularis of the most prominently presenting tenial band of the colon.

Before dividing the colonic loop, especially where glass drains are used, some Surgeons crush the colon with a powerful enterotribe _ after which the bowel is divided in the middle of the crushed area, and the crushed margins tied around the ends of the drains.

Sometimes the loop of sigmoid, with a short mesentery, or bound down by adhesions, must be mobilized, before it can be used in the colostomy. If it cannot be sufficiently freed by cutting the outer leaf of the mesentery, the relatively non-vascular aspect of the mesentery, then the mesentery may have to be divided upon its inner aspect _ in which case, the corresponding mesenteric vessels will have to be ligated _ but this will not be serious (provided that strictly those of the part of the loop to be drawn above the skin level be cut), for the center of the loop will slough, or be cut away, under any circumstances.

ANTERIOR INTRAMUSCULAR COLOSTOMY

MIXTER'S OPERATION

Description.—The sigmoid is brought out through the split right rectus muscle, which is sutured between the limbs of the loop _ after which a bridge of

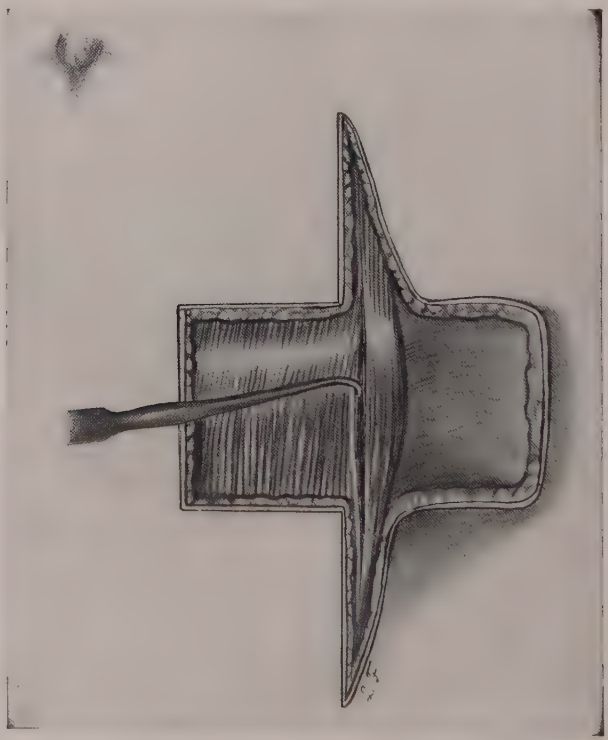


Fig. 4055.—Mixter's Aniterior Intramuscular Colostomy _ I; _ Quadrilateral flap of skin and fascia turned outward, exposng rectus. Separation of fibers in outer part of rectus. (Redrawn from Gould.)

skin and fascia is sutured under the loop and between the distal and proxima limbs. In this method some muscular control of the openings is secured, and the openings of the proximal and distal ends are separated some distance from each other.

Preparation _ Position _ Landmarks.—As in Left Inguinal Colostomy, page 8.

Incision.—Commences on a level with the umbilicus, over the outer third of the right rectus muscle _ passes vertically downward for 5 cm. (2 inches) through skin and fascia to the musculature _ thence turns inward at a right angle and runs in a straight line for 5 cm. (2 inches) _ thence downward at a right angle and runs in a straight line for 5 cm. (2 inches) _ thence outward

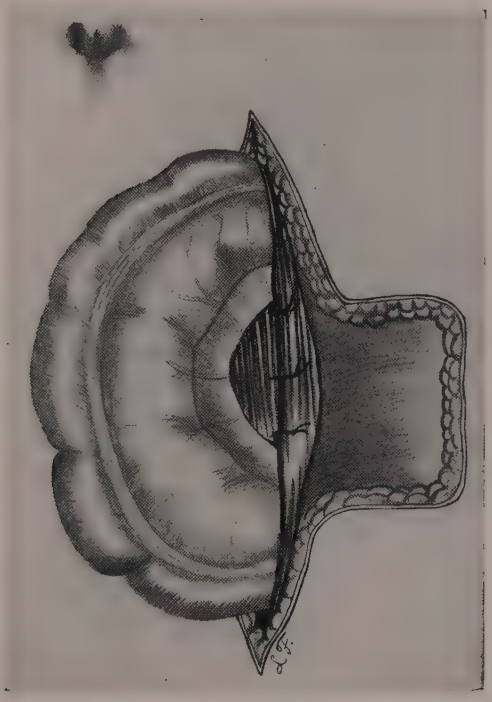


Fig. 4056.—Mixter's Anterior Intramuscular Colostomy _ II; _ Loop of sigmoid drawn through separated fibers of rectus _ taut mesentery incised _ median portion of rectal fibers sutured together between proximal and distal coils. (Redrawn from Gould.)

at a right angle and runs in a straight line for 5 cm. (2 inches) _ and finally turns again at a right angle and runs downward in a straight line for 5 cm. (2 inches) _ as shown in Fig. 4055.

Operation.—The flap thus indicated, consisting of skin and connective tissue, overlying the abdominal muscles, is raised and retracted outward _ as shown in Fig. 4056. The anterior layer of the rectal sheath is incised, and the longitudinal fibers of the rectus are separated in the outer part of the rectus by blunt dissection. The posterior layer of the rectal sheath, transversalis fascia, subserous areolar tissue, and peritoneum are incised in the same longitudinal line. The sigmoid is located and brought out of the abdomen through this opening and the loop of intestine pulled upon until both of its limbs are taut _ to render prolapse less likely. The mesentery of the

sigmoid is incised at a right angle to the long axis of the bowel for about 5 cm. (2 inches). The incised edges of the mesentery are retracted _ while the central portion of the separated border of the split rectus are sutured together with catgut sutures through the margins of the incised mesentery (Fig. 4056). Over the sutured portion of the rectus muscle, and under the coil of sigmoid, the skin-flap is sutured into its original position by means of one layer of interrupted sutures through the fascia and another through the skin. The two limbs of sigmoid are thus separated, over a space of about 5 cm. (2 inches), by a bridge of muscle, fascia, and skin. Where acute obstruction exists, a right-angled Mixter glass tube, of large size, is introduced

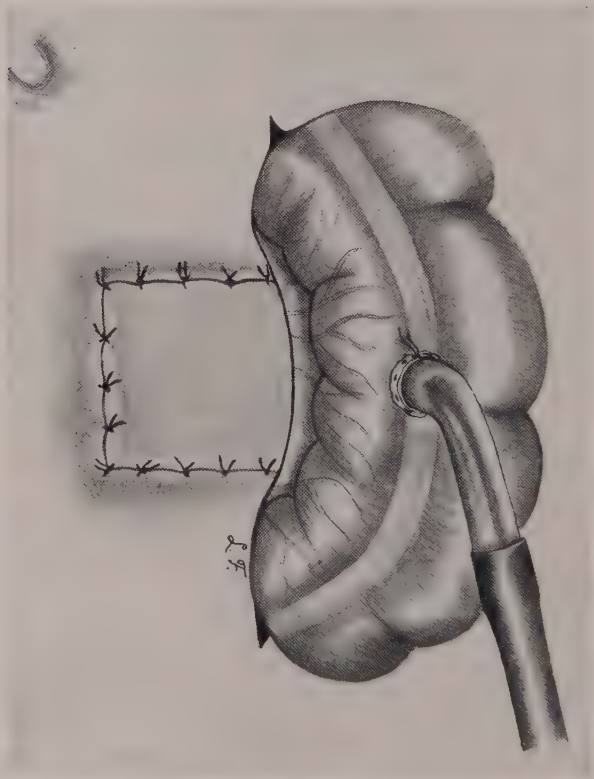


Fig. 4057.—Mixter's Anterior Intramuscular Colostomy _ III; _ Skin and fascia flap sutured back into place beneath arch of sigmoid. Mixter tube sutured into intestine. (Redrawn from Gould.)

into the lumen of the intestine at once and held *in situ* by a purse-string suture (Fig. 4057). A rubber tube is attached to the glass tube and carried to a receptacle for feces. The intestine is dusted with zinc oxid powder and covered with gutta-percha tissue, in order to prevent the peritoneal coats from adhering to the dressings. If no necessity exist for haste, the dressing is removed in four or five days and the loop of intestine excised about 1.3 cm. ($\frac{1}{2}$ inch) above the skin surface. The mucous membrane is trimmed to the level of the muscle coats, and the free margins whipped with a continuous suture (Fig. 4058). The upper, or proximal, and the lower, or distal, openings will lie some distance from each other _ thus preventing feces from the former from getting into the latter _ the proximal opening serving for the escape of feces and the distal



Fig. 4058.—Mixter's Anterior Intramuscular Colostomy IV; _ The sigmoid loop excised 1.3 cm. (½ inch) from skin _ and the afferent and efferent ends sutured to the skin. (Redrawn from Gould.)



Fig. 4059.—Left Inguinal Colostomy by Means of a Sigmoid Loop Brought Through Between the Vertically Separated Fibers of the Left Rectus Muscle.

for irrigation of the lower bowel, where that is indicated. The split rectus muscle furnishes some degree of sphincteric control.

Comments.—A simple form of procedure in this type of operation is seen in Fig. 4059 where there is no trap-door effect, but all the tissues are split in one straight line.

TEMPORARY LEFT INGUINAL INTRAMUSCULAR COLOSTOMY

TUTTLE'S OPERATION

Description.—The sigmoid colon is exposed through the ordinary "grid-iron" intramuscular operation — and is then anchored outside of the skin level by the Maydl-Reclus technic. After the peritoneal cavity is well sealed off by adhesions, the temporary opening of the loop of intestine, and its ultimate closure, are carried out by the special Tuttle method of procedure.

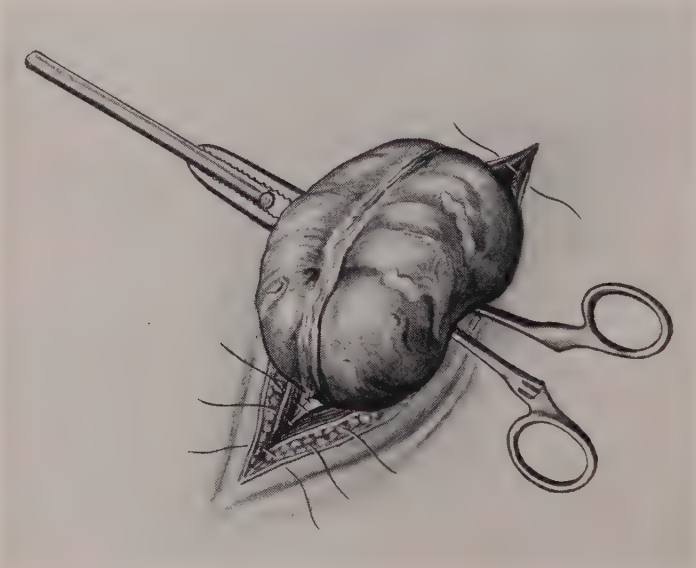


Fig. 4060.—Maydl-Reclus Method of Left Inguinal Colostomy — Adopted as a preliminary stage of Tuttle's technic for left inguinal intramuscular colostomy — I; — A loop of sigmoid colon has been delivered into the wound — and a pair of forceps, pushed through the mesentery, is seen drawing back a glass rod, to span the lips of the abdominal wound and support the coil. The peritoneum, muscles, and skin are closed at the ends.

Operation.—The intramuscular exposure is made through an incision which is placed 2.5 cm. (1 inch) above, and parallel with Poupart's ligament — beginning 3.7 cm. ($1\frac{1}{2}$ inch) inside of the anterior superior iliac spine, and extending downward for 7.7 cm. (3 inches).

Having opened the abdomen, and before proceeding with the special operation, a hand is introduced and the abdominal and pelvic cavities examined. If the result of the examination be favorable, the sigmoid loop is drawn out — and the details of the colostomy performed. The Maydl-Reclus method of holding the loop of sigmoid in the wound is adopted (Fig. 4060), a glass bar (6 mm. [$\frac{1}{4}$ inch] thick and 10 cm. [4 inches] long) being drawn through an opening made in the mesentery for the loop to rest upon, as the bar spans the edges of the abdominal wound. The lower end of the lower aspect of the

wound is then sutured with silkworm filament through all of its coats _ the sutures proceeding toward the center of the wound sufficiently to compress the distal limb of the intestine against the glass rod, so as to interfere with the passage of intestinal contents from the upper into the lower intestinal limb. Finally, fine chromic catgut sutures are passed through skin and peritoneum, then through the outer coats of the colon, and through peritoneum and skin of the opposite side _ these stitches being passed so as to give suture anchorage to each end of the intestine. It is safer to pass all stitches before any are tied, to safeguard the neighboring intestines. The protruding loop of intestine is smeared with sterile vaselin and covered with rubber tissue and gauze _ after placing folds of gauze under the glass rod _ which rests across the wound in the position shown in Fig. 4061

The bowel is never opened at this time. If it must be deflated, this is done through a trocar puncture, which is at once closed by suture. The intestine can be opened safely at any time after six hours _ but it is well to wait for two or three days, if possible.

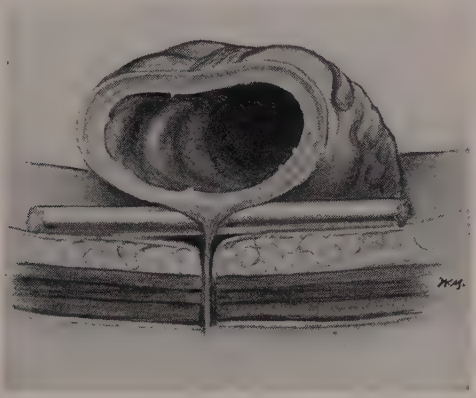


Fig. 4061.—The Same _ II; _ The features of the preceding illustration shown in cross-section. The glass rod is seen piercing the mesentery and resting across the lips of the wound, which lie in contact with the mesentery.

At the elected time, the bowel is opened in the following manner: An incision is made through the longitudinal muscular band, commencing at the superior angle of the abdominal wound, and extending to 1.2 cm. ($\frac{1}{2}$ inch) below the position of the supporting rod. A transverse incision is made at the lower end of, and at a right angle to, the axial incision, _ through two-thirds of the circumference of the bowel _ all of the incisions passing through all of the coats. As a result of these cuts the two small right-angled flaps formed at the lower part of the proximal limb roll backward and curl up upon themselves like drying rose petals _ while, at the same time, the straight transverse border of the cut in the lower or distal limb of the bowel draws downward and inward, tending to shut off the fecal discharge of the proximal limb from getting into the distal limb (Fig. 4062), _ unless it be desired to irrigate the distal limb, which may be accomplished by slightly elevating the transverse flap.

After the temporary fecal fistula has served its purpose, the intestinal canal is restored without any loss of its substance _ by suturing together the freshened edges of the T-shaped wound in the bowel, and mobilizing the site of anchorage from the abdominal wall and dropping it back into the abdomen.



Fig. 4062.—Temporary Left Inguinal Intramuscular Colostomy—Tuttle—I;—An axial incision is made along the longitudinal muscular band, into the bowel, from the upper angle of the wound to just below the artificially produced spur—and the lower end of this wound connected by a transverse incision into the intestine, extending through two-thirds of its circumference. The lumen of the proximal end is thus opened, while that of the distal end is partially closed in a valve-like manner. The wound of the abdominal wall is largely healed.



Fig. 4063.—The Same—II;—The margins of the coiled-up flaps of the proximal limb of the loop are first unfolded and freshened: a, a, Penetrating sutures through all the intestinal coats;—b, b, Lembert sutures of the outer coats.

This is accomplished in the following manner: The two small triangular flaps, made from the wall of the lower end of the proximal limb of bowel, which have rolled up and become more or less adherent during healing, are

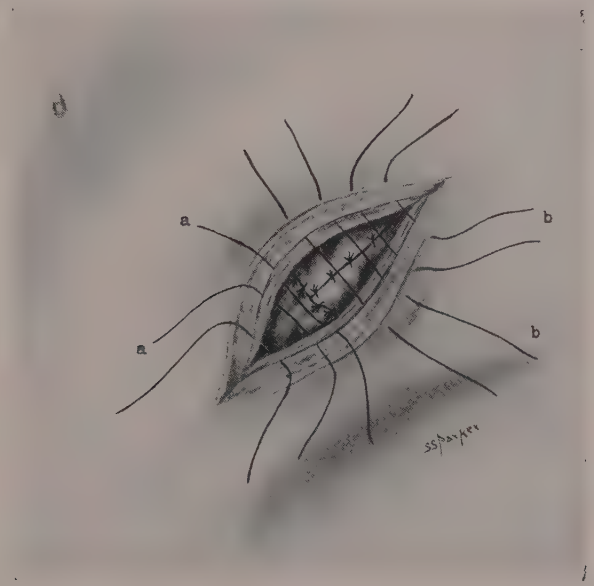


Fig. 4064.—The Same—III;—Surface view of the preceding figure, seen below the abdominal wall a, a, Sutures closing the peritoneum and muscle wall;—b, b, sutures closing the skin and fascia.

unrolled and freed from their adhesions by blunt dissection. The edges of these two flaps and the free transverse margin of the distal limb are freshened —and the free borders brought together by silk sutures—Czerny sutures of



Fig. 4065.—The Same—IV;—Cross-sectional view of the preceding illustration—showing the sutured intestine returned to the abdomen, lying shut off from the general cavity through the surrounding adhesions.

the mucosa, and Lemberts, of the outer coats, as described by Tuttle. Probably even more satisfactory is a first row of fine chromic sutures through the margins of all the coats, followed by a second row of silk Lemberts through the outer coats—as shown in Fig. 4063. When the suturing has been com-

pleted, the loop of bowel, at the site where it has formed the fecal fistula, is freed from the abdominal wall, down to the parietal peritoneum. And the parietal peritoneum is then bluntly detached from the abdominal wall to the limit of about 2.5 cm. (1 inch) all around the site of former anchorage. This freeing of the peritoneum allows the sutured bowel to drop back into the abdominal cavity to below the level of the abdominal wall (Fig. 4064). This freeing of the site of the colostomy has freshened the margins of the abdominal wound _ which is brought together by silkworm sutures passing through all the layers of the abdominal wall.

The continuity of the bowel is thus restored without opening the peritoneal cavity _ and the sutured intestine rests suspended, hammock fashion, by its adhesions and the partially separated peritoneum, where the latter has been bluntly dissected from the abdominal wall _ as diagrammatically represented in Fig. 4065.

PERMANENT LEFT INGUINAL INTRAMUSCULAR COLOSTOMY

TUTTLE'S OPERATION

Description.—The sigmoid colon is here exposed through an ordinary "gridiron" intramuscular operation _ drawn through a special split made in

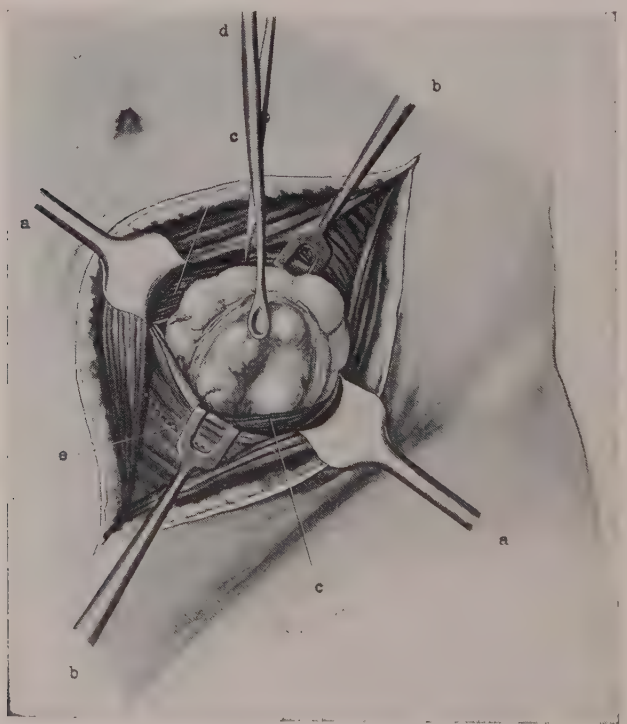


Fig. 4066.—Permanent Left Inguinal Intramuscular Colostomy _ Tuttle _ I: _ a, a, Retractors separating fibers of the external oblique; _ b, b, tractors drawing back margins of the internal oblique; _ c, c, split (separated) margins of the transversalis and divided fascia; _ d, intestinal forceps withdrawing a coil of sigmoid (here somewhat twisted upon its axis); _ e, site at which the fibers of the internal oblique will be separated in their cleavage line.

the internal oblique _ through a connective-tissue canal between the external oblique and skin _ and anchored in an incision made in the skin just above

and parallel with Poupart's ligament _ constituting a permanent artificial anus.

Operation.—Up to the opening of the abdomen, the steps of the procedure are exactly the same as those already described in the "gridiron" intramuscular technic (Vol. IV, p. 121). An examining finger then determines the condition of the parts _ and draws out of the cavity a loop of sigmoid _ a loop sufficiently long to extend about 5 cm. (2 inches) outside of the abdominal cavity. At the apex of the loop a small opening is made in a non-vascular area of the mesentery, through which a piece of gauze is run, and loosely knotted (or the ends left long, and held by a clamp) _ or a coarse, soft ligature _ for the subsequent manipulation of the loop.

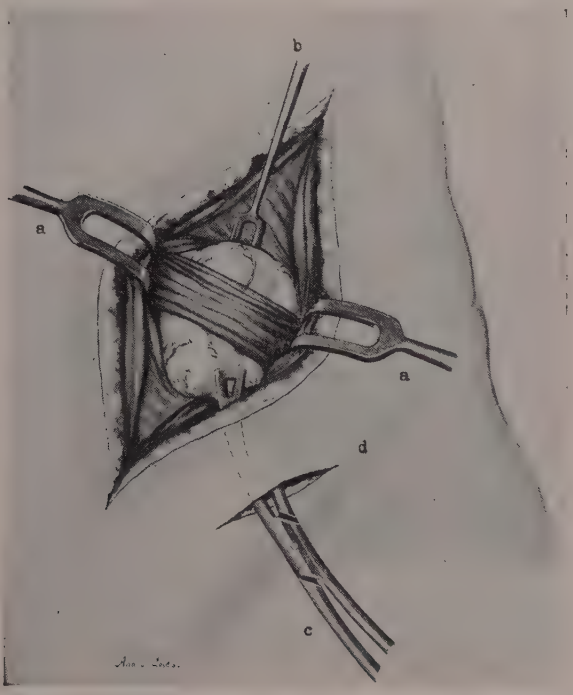


Fig. 4067.—The Same _ II: _ a, a, Tractors of external oblique muscle, separated in its cleavage line; _ b, tractor of outer aspect of internal oblique, also separated in its cleavage line, and of the underlying transversalis _ through which opening the colon is delivered; _ c, curved forceps drawing loop of the sigmoid through a split in the internal oblique _ over the lower part of the external oblique _ and out, between the external oblique and fascia, just above Poupart's ligament, at d.

The two borders of the split external oblique are now retracted well to each side, so as to expose the internal oblique as well as possible, especially the lower split lip of this muscle _ and an incision is there made, through the lower aspect of the exposed part of the internal oblique, parallel with the lower split border and about 1.2 cm. ($\frac{1}{2}$ inch) from it _ the incision being about 2 cm. ($\frac{3}{4}$ inch) in length (Fig. 4066). A skin incision (about 5 cm., or 2 inches in length) is then made just above Poupart's ligament, and below the lower, outer aspect of the main wound _ and, by blunt dissection, a canal is tunneled in the connective-tissue plane, between the skin and the aponeurosis of the external oblique, and nearer the latter (Fig. 4067, d). A pair of forceps is carried through this tunnel, from without inward, and grasps the loop of

gauze or ligature which has been placed around the sigmoidal loop, or grasps the sigmoid itself (Fig. 4067, c). When all is in readiness _ and it is felt that the opening made through the lower part of the internal oblique, and the connective tissue tunnel, are amply large to admit of the loop of sigmoid being drawn through without too much compression and traumatism, and still small enough to make a snug fitting (and both points are important), traction is made upon the sigmoid _ drawing it, first, out of the abdomen through the secondary split in the internal oblique, and then through the canal between the external oblique and skin (Fig. 4068) until it emerges through the skin opening just above Poupart's ligament.

The loop of sigmoid is held at its exit from the skin opening by means of a glass rod, passed through its mesentery, adjusted as shown in Fig. 4060, or

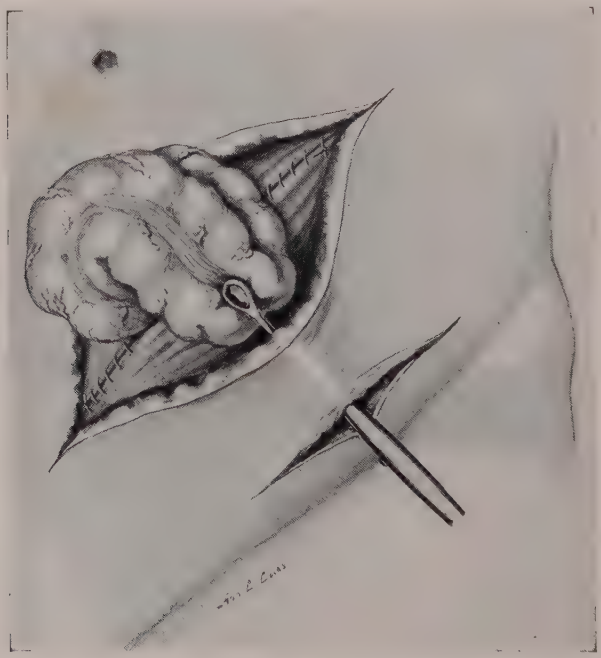


Fig. 4068.—The Same _ III; _ The separated fibers of the external oblique have been sutured, save where the two coils of intestine come through. Intestinal forceps are drawing the loop of sigmoid beneath the skin _ along a tract between the fascia and external oblique _ through an opening just above Poupart's ligament.

by suture of its mesentery to the margins of the wound. The abdominal wound is then closed. Any excess of opening in the transversalis is sutured from either end. The original split in the internal oblique is entirely closed with chromic catgut (as the intestine emerges through the secondary slit) _ and the split external oblique is closed from each end, leaving a comfortable exit for the two limbs of the sigmoid. Finally, the skin of the main wound is entirely sutured with silkworm filament _ and any excess of opening in the secondary skin wound is closed (Fig. 4069).

The protruding loop of sigmoid is protected with rubber tissue and gauze, and not opened for from twenty-four to forty-eight hours, unless emergency demand an earlier opening _ and, in this case, the intestinal loop is divibed, and the Paul tubes tied into the two parallel limbs of bowel. If the loop de

incised, after an interval, the incision is axial. After an additional period of a week or ten days the excess of protruding loop, with its now central opening, is trimmed down to a level just above the skin.

Comment.—The sigmoid is thus controlled in a twofold fashion, – its emergence between the fibers of the split internal oblique affords some voluntary control, – and the fact that the portion of the bowel distal to the split internal oblique rests upon the resistant aponeurosis of the external oblique, makes it possible to compress the bowel against this effectually, by means of a single spring hernial truss, with elongated pad. The statement made by Tuttle is as follows: – "In the majority of cases no compressing apparatus is necessary,

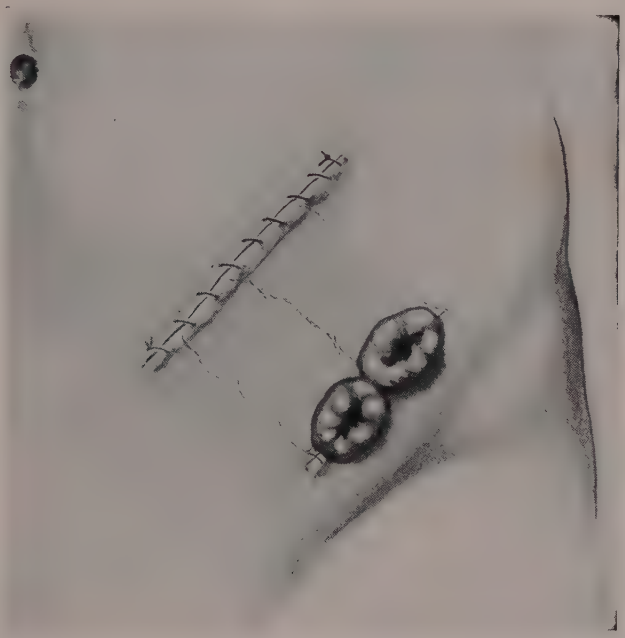


Fig. 4069.—The Same – IV; – The loop of sigmoid is anchored just above Poupart's ligament – each limb of the loop following incision of the knuckle, opening separately. The original wound is closed in the usual manner

as the patient usually possesses almost complete continence without it Not only is the continence obtained by this method exceedingly satisfactory, but the site of the anus is very convenient for the patient."

PERMANENT COLOSTOMY

LILIENTHAL'S TECHNIC

Description.—The especial features of this procedure are: – the large degree of control which the patient has over the opening – and the easy position of the opening, for the care of the fecal flow. Lilienthal states, – "Patients have absolute control of the bowels and can even hold a considerable quantity of fluid injected into the colon" – and that the bowels move once daily, and that he is not annoyed by the necessity of wearing an appliance for obturation.

Operation.—An incision 9 cm. ($3\frac{1}{2}$ inches), more or less, is made over the outer third of the left rectus muscle, and parallel with its fibers – its upper end being about on a level with the line between the left anterior superior iliac



Fig. 4070.—PERMANENT COLOSTOMY – Lilienthal – I; – The sigmoid loop drawn out of the abdominal wound and sutured to the peritoneum and rectal sheath.

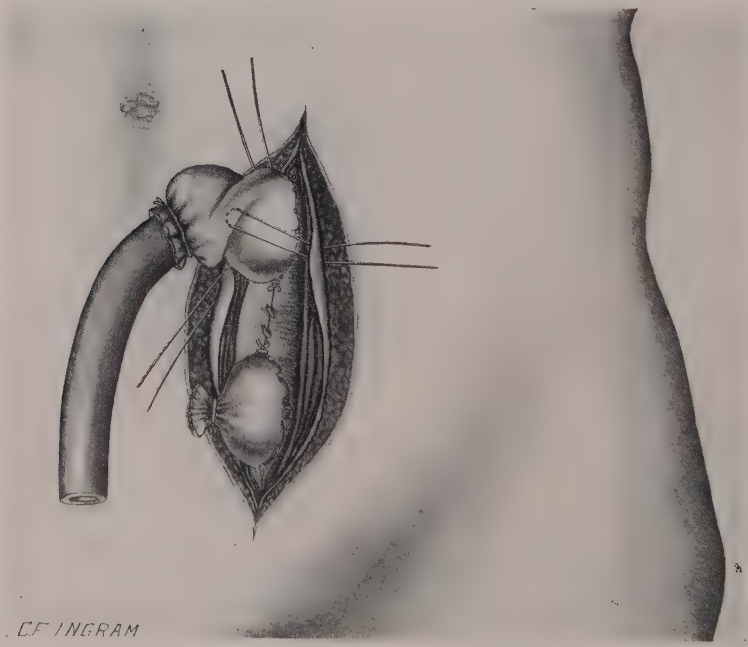


Fig 4071.—The Same – II; – The sigmoid loop divided – the lower limb ligated and anchored. The upper limb is in the act of being twisted and anchored – after which the wound will be closed in the usual way.

spine and the umbilicus, and passing thence, downward. On opening the abdomen, through the split rectus, all of the sigmoid flexure is drawn out of the cavity which will come without tension. The two limbs of the loop are then as widely separated as possible _ after which the upper limb is sutured to the peritoneum and posterior rectal sheath, in the upper angle of the wound (Fig. 4070) _ and the lower limb is similarly sutured to the peritoneum and posterior rectal sheath, in the lower angle of the wound. The suturing is done with silk, or thread, in continuous fashion _ except that the suture is tied at every third stitch, so as to avoid the strangulating tendency of a purse-string suture. The mesosigmoid is next sutured, through and through, to the peritoneum on each side.

At the lower leg of the loop the intestine is doubly ligated, very tightly, with heavy cotton, or silk, and divided between the ligatures (Fig. 4071). The end of the bowel is disinfected. The mesosigmoid is ligated. The remaining part of the sigmoid loop is then cut away from the upper leg of the loop, leaving a sufficient amount for manipulation projecting from the upper angle of the wound. The margins of this upper piece of intestine are then seized with four clamp forceps, and twisted upon the intestinal axis through from 180 to 360 degrees (Gersuny's method), after which the intestinal end is anchored by sutures which unite the visceral peritoneum and submucosa to the aponeurosis of the external oblique.

In this way two sphincter-like barriers are made _ the first, at the twist _ and the second, more an angulation than a sphincter, at the point of peritoneal fixation. In addition, is the voluntary contraction of the fibers of the split rectus muscle.

The remaining portion of the aponeurosis is closed by chromic catgut _ and the rest of the wound is left open.

In completing the operation a large size, stiff-walled rectal tube is inserted into the bowel for 15.3 cm. (6 inches) and the end of the intestine tied about it.

The rectal tube is withdrawn in one week, and excessive granulations burned off by the cautery. The circular ligature of the lower limb of the loop is removed in three or four days. The patient learns to control the bowel functioning.

OTHER TECHNICAL PROCEDURES IN CONNECTION WITH INGUINAL COLOSTOMY

Various mechanical methods have been devised for supporting the loop of sigmoid outside of the abdominal wall _ usually by piercing the mesentery of the loop and resting upon the abdominal wall on either side of the incision, which the support crosses transversely. Some of these methods are here given:

Maydl-Reclus' Method of Supporting the Sigmoid Loop.—The knuckle of intestine is drawn out _ the glass rod passed through the mesentery _ the limbs of the loop sutured together as above, _ following which the steps will differ as to the object sought: _ (*a*) If the intestine is to be opened at once _ it is stitched to the parietal peritoneum, as described above; _ (*b*) If the intestine is not to be opened at once _ it is not stitched, but simply gauze is packed around and under the glass rod; _ (*c*) If the opening is to be permanent _ the bowel is to be divided transversely in from four to six days, through one-third of its diameter _ an irrigating tube is then inserted and the intestines washed out _ and in two to three weeks later the transverse division is completed _ the edges of the proximal gut are sutured to the margins of the skin and the distal end left unsutured _ and the rod is then withdrawn; _ (*d*) If the opening is to be temporary _ the intestine is incised in its long axis _ and, when the

opening is ready to be dispensed with, the rod is withdrawn and the knuckle of intestine allowed to retract (no suturing to the skin having taken place) – the opening often closing of its own accord.

The technic is illustrated as a preliminary step in the description of Tuttle's method of performing temporary colostomy, p. 26.

A clever method of preventing the glass rod, in the Maydl method, from slipping out from the mesenteric opening, and possibly allowing the intestine to be drawn back into the abdomen, is shown in Fig. 4072.

Ball's Method of Supporting the Intestinal Loop.—Double ligatures, knotted at both sides, or a return ligature – of stout silk, or linen, is passed through the entire thickness of each lip of the abdominal wound, inclusive of

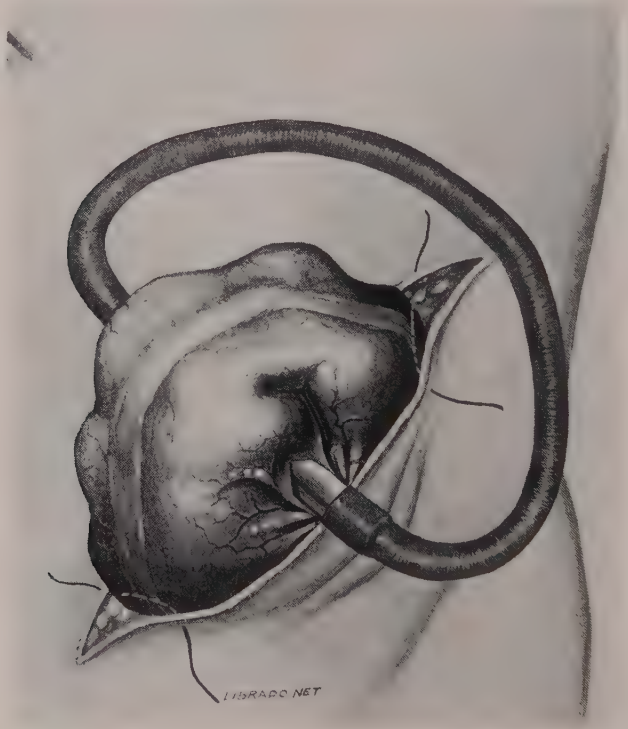


Fig. 4072.—Glass Rod Support of the Sigmoid Loop, in Left Inguinal Colostomy – the rod being held in place by slipping the ends of a rubber tube over them – as suggested by Makins.

the peritoneum – and through the mesentery of the loop of bowel. On each side the ligature passes through the openings of a metallic plate, or simple broad button – and is knotted with sufficient tension to bring together both sides of the abdominal wound against the mesentery of the intestine (Fig. 4073). The advantage of this particular method is that, apart from supporting the loop, it compresses the sides of the abdominal opening together, against the mesentery.

Mathew's Method of Supporting the Loop of Bowel.—Ordinary long pins, of the hat-pin order, may be here used – although special types of pins are made for the purpose. Two of these are carried parallel, through all the coats of one margin of the abdominal wound – through the mesentery of the

sigmoid loop, and through all the coats of the opposite margin of the abdominal wound, where their ends are made to bury themselves into a sterile cork. At the ends of the wound sutures are passed through all the tissues of each lip of the abdominal wound, and through the outer coats of the longitudinal band of the colon. The technic is seen in Fig. 4074.

Several different methods have been employed in the attempt to secure some degree of muscular control over the bowel contents, as has already been explained in the intramuscular operations described and illustrated. Two or three other technical procedures to this end are given below:

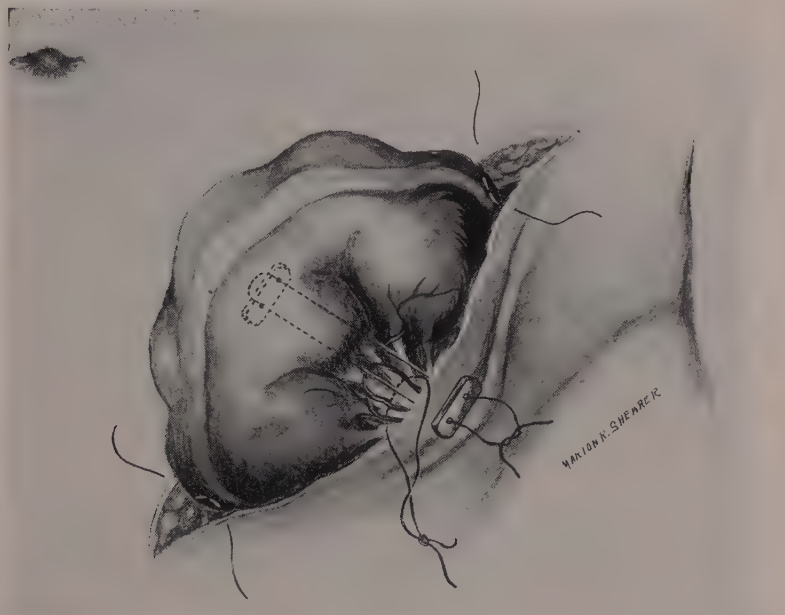


Fig. 4073.—Ball's Inguinal Colostomy; Double ligature passed through the entire thickness of the abdominal wall, including the peritoneum, through the mesentery, and through the opposite wall of the abdominal wound. Each end of the double ligature of each side is passed through openings in a metallic plate, or button, and tied, thus compressing the sides of the abdominal wound against the mesentery and both limbs of the sigmoid. Terminal sutures pass through both walls of the wound and the longitudinal bands of the sigmoid. A provisional ligature is applied at the time of the original operation, surrounding the main mesenteric vessels, and left untied for future hemorrhage control when the intestine is incised.

Witzel's Permanent Left Inguinal Colostomy, with Partial Muscular Control.—Witzel was the first to adopt this particular type of operation, of which there have been a number of modifications. He drew the sigmoidal loop out of the abdominal cavity and then through a pathway separated between the external and internal oblique muscles, through an opening in the external oblique, over the brim of the pelvis, and then conducted the double-limbed loop over the brim, through a continuation of the connective-tissue tunnel, and finally brought the loop out about 2.5 cm. (1 inch) below the iliac crest, that is, upon the outer aspect of the extreme upper part of the thigh, and attached it (Fig. 4075).

Weir's Permanent Left Inguinal Colostomy, with Partial Muscular Control.—In this method, after delivering the loop through the usual intra-

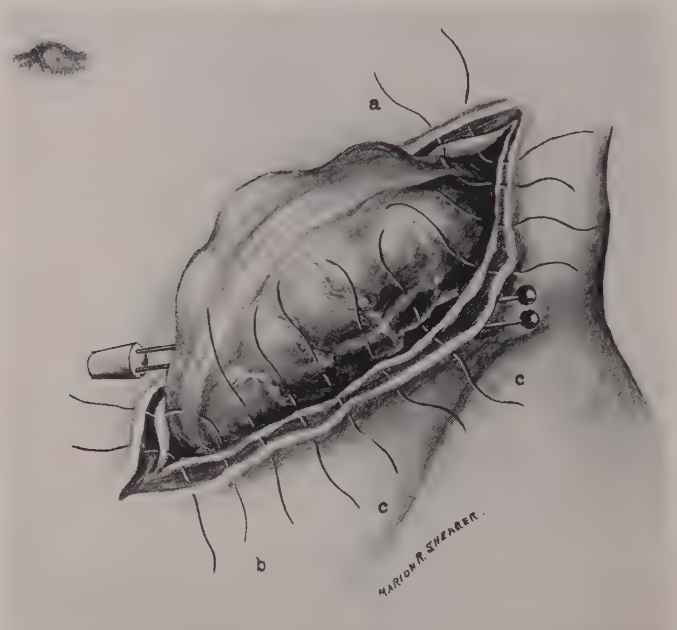


Fig. 4074.—MATHEW'S INGUINAL COLOSTOMY; – Having delivered the loop of sigmoid, two "hat-pins" are passed through the abdominal wall, through the mesentery, and through the abdominal wall of the opposite side: a, b, Sutures passing through the skin, peritoneum, longitudinal band, peritoneum, and skin; – c, c, suture passing through skin, peritoneum, and outer layers of the intestine.



Fig. 4075.—WITZEL'S PERMANENT LEFT INGUINAL COLOSTOMY, WITH PARTIAL MUSCULAR CONTROL; – Heavy ligature, or tape, passed through the mesentery of the sigmoid loop – and then conducted between the internal and external oblique muscles, by blunt dissection, over the iliac crest, and out through the skin, 2.5 cm. (1 inch) below the crest, where it is anchored.



Fig. 4076.—Weir's Permanent Left Inguinal Colostomy, with Partial Muscular Control; – Having delivered and divided the sigmoid loop, the distal end is sutured and dropped back into the cavity. The proximal end, temporarily ligated, is conducted, by means of the long ends of the ligatures, between the internal and external oblique muscles – over the iliac crest – and under the gluteal skin, to a level about 5 cm (2 inches) beneath the crest – and there anchored.



Fig. 4077.—Gant's Inguinal Colostomy, with Partial Muscular Control; – A passage for the loop of colon is tunneled by blunt dissection of the finger, outward between the transversalis and internal oblique – *through* the internal and external oblique – inward between the external oblique and connective tissue – and out through the wound of abdominal section.

muscular operation, it is divided, and the distal end closed and dropped back into the abdomen. The proximal loop, whose end has been temporarily controlled by ligature, and disinfected, is then drawn through a canal made by

blunt dissection between the internal and external oblique muscles, to a point just above the iliac crest, where the external oblique is tunneled and the connective-tissue canal continued under the skin, for a distance of about 5 cm. (2 inches) below the crest, upon the femorogluteal aspect, where the circumference of the bowel end is attached to the margin of the skin opening. The sigmoid is also sutured to the parietal peritoneum at the point where it leaves the peritoneal cavity. The abdomen is closed as in the corresponding methods. The technic is suggested in Fig. 4076.

Gant's Permanent Inguinal Colostomy, with Partial Muscular Control.—After dividing the abdominal wall, the loop of sigmoid is drawn through a canal tunneled, first, between the transversalis and internal oblique muscles _ then through both the internal and external oblique _ then between the external oblique and skin _ and finally out through the same wound as the abdomen was entered _ thus giving four angulations to the bowel, through a canal which makes three turns, besides its entrance and exit _ as shown in Fig. 4077.

Gibson's Valvular Colostomy.—The abdomen is entered through an intramuscular operation. The sigmoid loop is brought to the surface and a

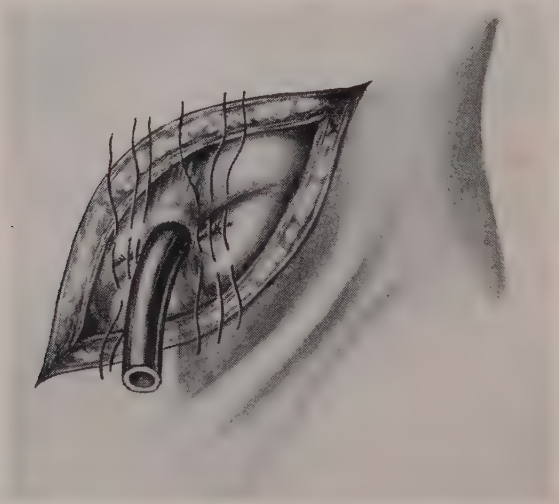


Fig. 4078.—Gibson's Valvular Colostomy; _ The first tier of sutures has been placed and tied _ and the second tier, hiding the first, have been placed and ready to be tied _ thus banking up the walls of the colon around the rubber tube entering its lumen through the longitudinal muscular band.

rubber tube is carried, through a limited incision, into its interior _ after which the wall of the sigmoid is built up around the tube after the fashion that a tube is buried in the cavity of the stomach by the Kader technic (Vol. IV, p. 269) by means of two or more tiers of Lembert stitches (Fig. 4078).

OPERATIVE CLOSURE OF THE OPENINGS OF FECAL FISTULA AND ARTIFICIAL ANI, FOLLOWING INGUINAL COLOSTOMY

The ease or difficulty to be expected in the operative closure of the openings made for temporary and for permanent intestinal openings _ fecal fistulæ and artificial ani, respectively _ will, naturally, depend largely upon the manner of making the original opening. The opening following colostomy for fecal fistula (temporary fistula) can usually be closed by a much simpler procedure than an opening made for artificial anus (permanent anus) _ owing

to the fact that in the latter a special effort has been made to construct a spur formation, which, while practically diverting feces from the proximal limb away from the distal limb, also consistently maintains this function when it is desired to bring about closure. The anomaly of speaking of the operative closure of a permanent artificial anus is recognized – but it is evident that it will sometimes happen that artificial ani, planned to be permanent, cease to be any longer required, through unexpected and favorable circumstances – and, under such circumstances, then require to be closed.

Operative Closure of Temporary Colostomy Openings.—This is usually not difficult – owing to the absence of spur formation. Indeed, such openings often close spontaneously, when the condition for which they were formed ceases to operate – up to which time it is not indicated to make any effort toward closure. In temporary fecal fistulæ only the convexity of the bowel, but little altered in its course, is supposed to be in contact with the abdominal

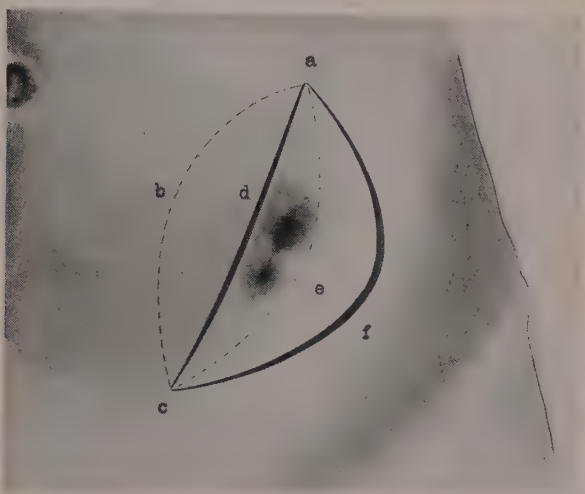


Fig. 4079.—Plastic Closure of Artificial Anus Following Left Inguinal Colostomy (Tuttle) – I: – A curved incision, **adc,** is made to the inner side of the fistula, and the skin freed back to **abc.** The curved incision, **afc,** is made, and the skin freed back to **aec.** The area, **adce,** is left intact. Having freed of epithelium the surfaces of the areas, **adce** and **aecf,** the flap, **aecf,** is hinged inward upon the curved line, **aec,** and stretched until it can be sutured, by mattress-sutures conducted upon a Reverdin needle, to the curved line, **abc.** The line, **adc,** is then sutured to the line, **afc.**

wall. Closure is usually readily effected by some simple form of plastic operation – such as the freeing of the wall of the intestinal opening from its connection with the abdominal wall, followed by the suturing together of the intestinal opening by a tier of through-and-through marginal stitches, followed by a second tier of non-penetrating stitches of the Lembert order (treating the raw connective tissue formed by the mobilization as though it were serous tissue). This freeing can usually be accomplished without opening the peritoneal cavity – and if this be limitedly opened by accident, or purposefully opened, ordinarily no harm results – the parts having been as thoroughly disinfected in advance as their nature permits. Following the closure of the intestinal opening, and provided the abdomen has not been opened, the soft parts overlying the abdominal musculature are mobilized and are then sutured together over the already sutured intestinal opening. If the peritoneal cavity has been opened, the abdominal opening may be closed, after closing the in-

testinal opening first, as though it were a hernial opening _ that is, by tier suturing or mass suturing _ and sometimes by overlapping.

Some forms of operation for temporary fistula also make special provision for the closure which must be made later _ and this is a notable feature of Tuttle's operation for temporary colostomy (p. 26).

A simple type of plastic closure applicable to average cases of temporary colostomy, in which only a small proportional part of the intestinal wall was involved in the colostomy opening, is the technic adopted by Tuttle from the principle evolved by Szymanoski for the closure of urethroperineal fistulæ. A semi-elliptic incision, **adc,** Fig. 4079, is carried through the skin, to the inner side of the double-opening fistula _ and is mobilized for about 2.5 cm. (1 inch) further inward, to the dotted line, **abc.** Another, more curved incision is made to the outer side of the fistula, **afc,** lying about 3.8 cm. ($1\frac{1}{2}$ inch) to its outer side _ and from this the superficial layer of skin is dissected, except that a small part of it immediately adjacent to the fistula, sufficient to

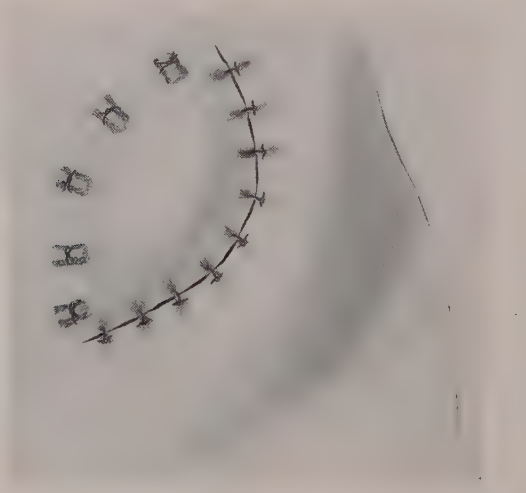


Fig. 4080.—The Same _ II; _ The mattress-sutures, placed as described in the preceding illustration, are tied over pledgets of gauze _ after which, the convex margin, adc (of the preceding picture),of the flap, adcb, is drawn over and anchored, by interrupted sutures, to the concave line, afc. All surfaces in contact are thus either raw connective tissue or de-epithelized skin.

cover the fistula, is not denuded. The flap, **afce,** is now raised throughout, except along its hinge, **aec.** This flap, **afce,** is then folded inward, hinging upon the curved line, **aec** _ and sutured to the freshened area from which the flap, **abcd,** has just been raised. This suturing is conveniently accomplished by a Reverdin needle _ and the stitches are tied over pledgets of gauze to prevent their cutting through (Fig. 4080). Then the flap, **adcb,** is drawn outward and sutured to the curved line, **afc.** This effects a closure of the fistulous opening by a double layer of skin. It would seem as though the area, **aecd,** up to the very margins of the mucous surfaces of the fistulæ, should also be denuded, so that when the denuded surface, **afce,** is applied to it, this surface, **afce,** will rest upon a surface also denuded, **aecd.**

In proportion as the temporary colostomy opening partakes of the features of the permanent colostomy opening, so the problems of closing the temporary fistula approximate those experienced in closing a permanent artificial anus.

Operative Closure of Artificial Ani Originally Intended to be Permanent Colostomy Openings.—The essential respect in which closure of these openings differs from those made for temporary colostomy is connected with the presence of the "spur." This structure, formed by the approximation and adherence (through adhesions alone, or through special suturing, in addition to adhesions), must invariably be destroyed, or be so modified as to no longer serve as an obstruction within the lumen of the bowel, to the onward passage of feces. Then, in addition to this, the disarrangement of the bowel may be

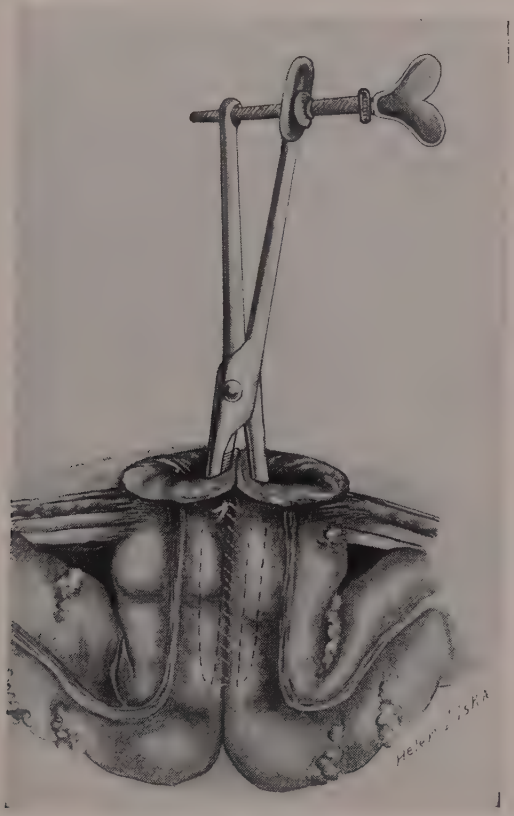


Fig. 4081.—Crushing the Spur of an Artificial Anus Preparatorily to Restoring the Continuity of the Bowel. The site of the continuous suture originally uniting (at the time of the operation) the mesenteric aspect of the two limbs of the sigmoid is represented by interrupted suturing (here still shown, anachronously). Dupuytren's enterotome is shown in the act of crushing away the spur intervening between the two barrels of intestine.

such, as a result of the special method of colostomy adopted in the original operation, that the only course open, or the best course, lies in an excision of the immediate site of the bowel opening, followed by end-to-end or side-to-side entero-enterostomy. The first effort, however, is to destroy the "spur," without entering the peritoneal cavity—and then to restore the continuity of the intestinal canal, also without entering the free abdomen.

As already mentioned, it is somewhat anomalous to speak of an operation to *close* a *permanent* artificial anus. The operation is called for, however, where, contrary to expectation, the need of its continuance is no longer neces-

sary, fortunately for the patient – whether this be from a mistaken diagnosis as to the original condition, which not infrequently happens, or where the correctly diagnosed condition unexpectedly disappears.

The most commonly applied method of destroying the "spur" of a "permanent artificial anus" is through some crushing, or clamping procedure, whereby the spur disappears under pressure necrosis. Some form of clamp is usually applied to the spur, one end of the clamp passing down each limb of the bowel, and tightened each day, until the arms of the clamp cut their way through. This ordinarily requires from five to six days – and is generally very painful. In applying the clamp method, it must be reasonably certain that the walls of the two limbs of colon which are to be crushed are everywhere in contact – that is, parallel and adherent – and not angulated, like an inverted V, so that some adjacent coil of intestine can slip in between. Under the former circumstances crushing can be done without danger – but in the latter the arms of the clamp cut through the opposite walls of the two colonic limbs of bowel, and then also crush whatever may intervene between these

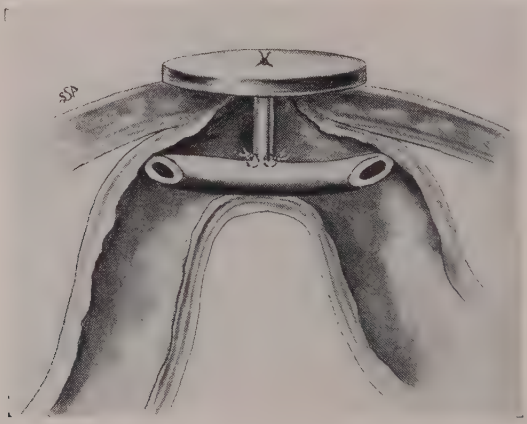


Fig. 4082.—Flattening the Remains of a Colostomy Spur; – Following the removal of the colostomy spur by pressure, an appliance improvised from rubber tubing, stout rubber cord, and sheet rubber is so inserted that the tubing tends to further straighten the floor of the sigmoid lumen, while the elliptic plate of rubber sheeting is pressed upon from without by the dressings.

limbs. This is one reason why it is so much safer to unite the two opposite walls of the two colonic limbs together by a few sutures – making it impossible for the clamps to injure any neighboring loop of intestine, because none can come between the attached limbs of colon. The general method of applying the clamp, or enterotribe (of which there are several varieties), is shown in Fig. 4081.

Following the destruction of the spur – especially if this destruction has not been complete – or in some cases where the spur is insignificant, and some other operation is deemed unnecessary – it is often well to resort to some mechanical device for smoothing out and still further lowering the remnant of "spur." Such a device, easily improvised, is shown in Fig. 4082. This is inserted in the manner suggested in the picture . the amount of pressure being exercised upon the spur being determined by the length of the shank of the button, as it were, and by the degree of the compressing bandage applied over the dressing, which tends to press, by transmitted pressure, the rubber tube down upon the spur.

Another method available is the use of Gant's colostomy clip, with fenestrated arms of different length, adjusted to the individual case. These are



Fig. 4083.—Removal of a Colostomy Spur with Gant's Colostomy Clip; – This clip is shown about to be released from special forceps so as to grasp and destroy by pressure a path between the contiguous walls of the colon.

applied as when used to destroy rectal valves. Their use to destroy the colostomy spur is shown in Fig. 4083.

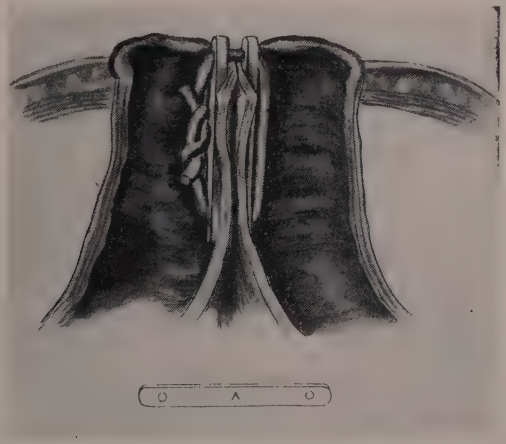


Fig. 4084.—Removal of Colostomy Spur by Elastic Pressure; – Two pierced aluminum plates in contact with contiguous walls of sigmoid loop. A solid rubber cord has been passed through the holes in the plates, by means of a Kurz needle, and tied – so as to compress the walls between the plates, causing pressure necrosis.

Ball's technic for removing the spur is the application of elastic pressure to cause necrosis, applied through the medium of a rubber cord tied through the two holes of two aluminum plates (Fig. 4084). The thumb and finger of

the left hand are run into the proximal and distal limbs of the colostomy opening, to determine whether any coil of small intestine lies between the two limbs of the larger intestine, by pinching together the colonic limbs. By means of a Kurz needle, pictured elsewhere (see Index), a silk ligature is passed through the contiguous walls of the colon about 3.8 cm. (1½ inch) from the open ends. An end of the silk is drawn out of each intestinal opening, and by means of this tractor the rubber cord is drawn through, until it takes the place of the silk, which is discarded. Two aluminum plates, about 3.8 cm. (1½ inch) in length, with holes bored at each end, are then threaded, through their lower holes, upon the rubber cord – after which the rubber cord is threaded through the upper holes, which are above the outlet, and tightened sufficiently to cause the requisite compression of the two intestinal walls between the two plates. The spur is cut through in about ten days, leaving a deep, cut-out furrow. The improvised rubber button, already pictured in Fig. 4082, is then used daily to complete the work of the compression plates.

The remnant of the spur may sometimes be still further lowered by the daily introduction of a Wales solid rubber bougie from the rectum, with its retention for a period of time – as shown in Fig. 4112, where it forms a part of the technic in partial colectomy by the Mikulicz method.

Finally, when the spur has been disposed of by one of the above methods, or some allied method, the necessity remains for closing the colostomy opening. At this stage this becomes, practically, the same kind of problem which is encountered in closing the colostomy opening after temporary colostomy (fecal fistula) – which has been already described (v. p. 40). This is usually a plastic procedure – consisting in the separation, by dissection, of the opening from the surrounding tissues, without, if possible, opening the abdomen, and then suturing together the margins of the opening in the colon by a first tier of marginal sutures – and a second reinforcing tier on the Lembert order (although not here dealing with serous surfaces, but simply with raw ones).

In some instances it is necessary to freely open the abdomen and make an excision of the former site of colostomy – followed by end-to-end or side-to-side colocolostomy. In such a case, of course, the labor and time of first destroying the spur are not undertaken. Following the colocolostomy, the abdomen is closed as it would be following an operation for hernia through the abdominal wall.

LEFT LUMBAR COLOSTOMY

Description.—Left lumbar colostomy (posterior colostomy, operation of Amussat) consists in making an opening posteriorly, through the loin, over the descending colon – extraperitoneally. The operation is performed, exceptionally, also over the posterior aspect of the ascending colon in the right loin.

Formerly, when opening the abdomen was accompanied by such high mortality, lumbar colostomy was the operation of choice, as compared with anterior inguinal colostomy – because of its being possible, usually, to expose the descending colon posteriorly without entering the free peritoneal cavity. At the present time, however, the operation stands practically discarded – after balancing-out its favorable and unfavorable bearings:

In Favor of Lumbar Colostomy as Compared with Inguinal Colostomy; – the peritoneum is usually not opened, – prolapse of bowel (hernia) is less likely to occur, – the operation cannot be made difficult by a bound-down bowel (as sometimes occurs in the anterior operation).

Against Lumbar Colostomy, as Compared with Inguinal Colostomy; – the small amount of working-room, in a deep loin, with short space between the

last rib and the iliac crest, – the presence, occasionally, of a mesocolon, – the difficulty, sometimes, of finding the colon, even if not congenitally absent from its normal position, – small amount of room to explore neighboring structures, – marked inconvenience in taking care of a bowel opening in that position, – and, negatively, the present small danger of the anterior transperitoneal operation.

The only partial indication for lumbar colostomy at the present day apparently is where a right lumbar colostomy might be chosen to take the place of a cecostomy.

The ascending colon has a mesentery in 26 per cent. – and the descending colon, in 36 per cent. of cases (Treves – Fig. 4085). This means that in those cases where a mesentery is encountered, in operating posteriorly, the operation cannot be completed extraperitoneally unless the leaves of the mesentery can be separated and the mesenteric aspect of the colon thus approached.

The positions of the ascending and descending colons are represented, in the loins, by vertical lines drawn upward from a point 1.3 cm. ($\frac{1}{2}$ inch) posterior

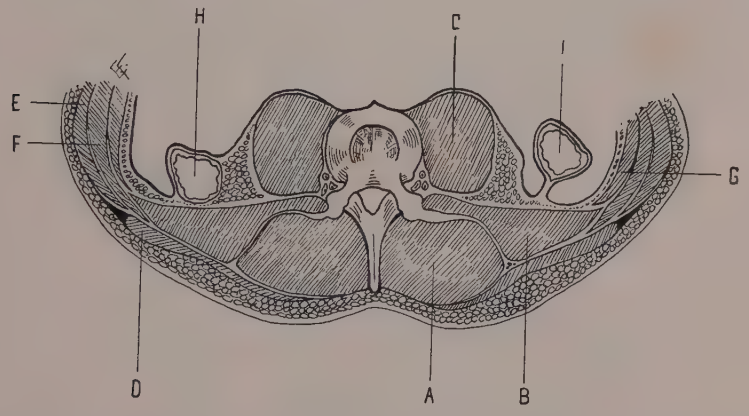


Fig. 4085.—Transverse Section of the Posterior Abdominal Wall in the Lumbar Region: – A, Erector spinæ muscle; – B, quadratus lumborum; – C, psoas magnus; – D, latissimus dorsi; – E, external oblique; – F, internal oblique; – G, transversalis; – H, the descending colon shown in its usual position, and without a mesentery, as usual; – I, the ascending colon shown with a mesentery (an exceptional occurrence). (Modified from Gray.)

to the center of the crest of the ilium (that is, a point 1.3 cm., or $\frac{1}{2}$ inch, posterior to a point midway between the anterior and posterior superior iliac spines).

Preparation – Position.—As for median abdominal section.

Position.—Patient lies upon opposite side and near edge of table, with a hard pillow, or support, under the opposite loin, to render prominent the site of operation, – Surgeon on side of operation, – Assistant opposite (Fig. 4086).

Landmarks.—Position of descending colon – namely, a line extending vertically upward from a point about 1.2 cm ($\frac{1}{2}$ inch) posterior to the center of the iliac crest to the twelfth rib – which line will about correspond with the outer border of the quadratus lumborum.

Incision.—About 7.5 to 10 cm. (3-4 inches) long – placed obliquely between the twelfth rib and the crest of the ilium, with its center over the center of the vertical line representing the course of the descending colon – which incision will run in the direction of a line extending from the anterior superior

iliac spine to the angle formed by the twelfth rib and the outer border of the erector spinæ muscle, the incision beginning at about the outer border of this muscle. (See Fig. 4087.)

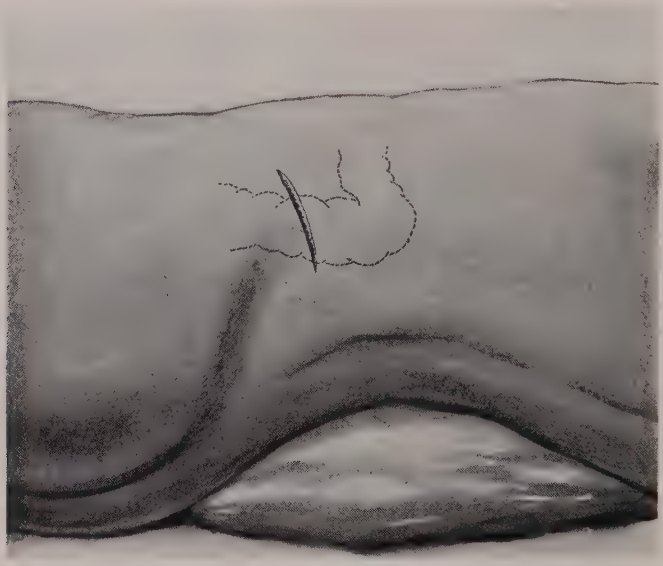


Fig. 4086.—Left Lumbar Colostomy _ I; _ Line of incision and position of patient.

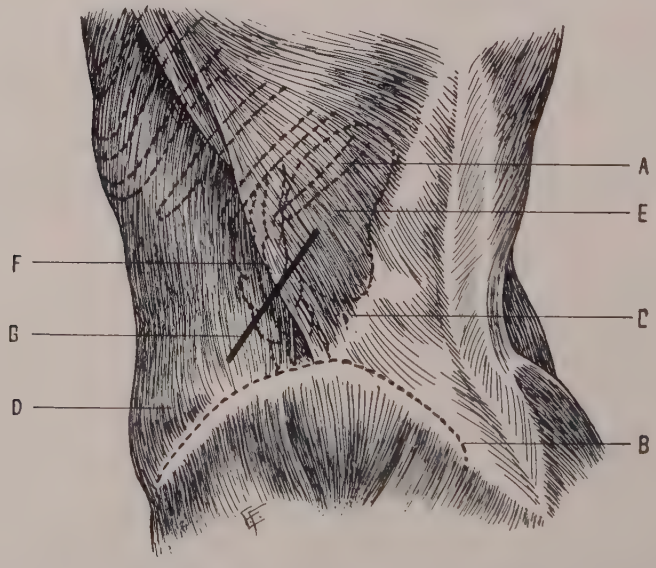


Fig. 4087.—Left Lumbar Colostomy: _ A, Twelfth rib; _ B, iliac crest; _ C, latissimus dorsi muscle; _ D, external oblique muscle; _ E, left kidney; _ F, descending colon; _ G, line of incision for left lumbar colostomy

Operation.—Divide the skin and the thick subcutaneous fatty fascia, clamping all vessels. Divide the latissimus dorsi and its aponeurosis in the

posterior part of the wound _ and the posterior part of the external oblique in the anterior part (Fig. 4088). Divide the internal oblique, exposing the lumbar fascia posteriorly. Recognize and protect the twelfth dorsal nerve and accompanying branch of the lumbar artery. Divide the lumbar fascia and the transversalis muscle, exposing the anterior margin of the quadratus lumborum (which rarely requires division) in the posterior angle of the wound, and the transversalis fascia. Divide the transversalis fascia, from the quadratus lumborum to the anterior angle of the wound, exposing the subperitoneal tissue _ avoiding the twelfth nerve on its way from the quadratus lumborum to the transversalis muscle.

A distended colon may now protrude through the subperitoneal connective tissue into the wound _ this areolar fatty tissue, often very thick and

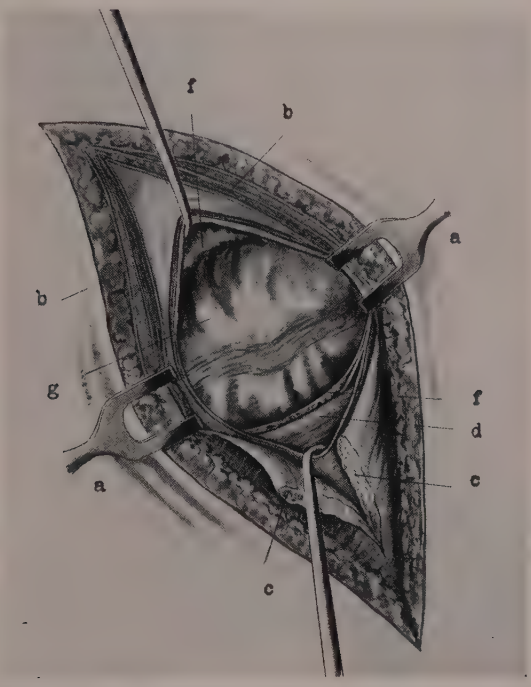


Fig. 4088.—The Same _ II: _ a, a, Retractors of divided external and internal oblique muscles, and of the transversalis muscle and aponeurosis; _ b, b, cross-section of external and internal oblique; _ c, c, divided latissimus dorsi; _ d, quadratus lumborum; _ e, retractor of the aponeurosis of the quadratus lumborum; _ f, pericolonic connective tissue; _ g, descending colon.

fatty, lying around the kidney, being separated by the fingers and forceps, or by a blunt dissector. If the colon does not thus protrude, insert an index-finger through this subperitoneal areolar tissue, while the parts are well retracted behind the lumbar fascia _ following, with the back of the finger toward the patient's back, along the anterior surface of the quadratus lumborum, aiming for the angle between the quadratus lumborum and the psoas, toward which angle the posterior surface of the colon presents, lying anterior to the plane of the kidney, the lower portion of which (kidney) is generally felt. The finger which has passed through the subperitoneal areolar tissue and is carefully working behind the peritoneum is aided in its search by rolling the body over toward the side of operation, while the Assistant presses the anterior

abdominal wall firmly, so as to aid the colon, by gravity and pressure, to fall, as it were, into the curved index-finger. The colon is generally recognized by the thickness of its wall, by the absence of the peritoneal coat, and sometimes by the posterior longitudinal band.

Grasp the non-mesenteric aspect of the colon with the fingers, or special forceps, and bring it out to a level with the surface – no loop being here drawn out of the wound as in the anterior operation. The colon is held in place with forceps, or temporarily allowed to fall back into place – while the excess of the abdominal wound is closed from either end – by layer suturing with chromic gut, or by mass suturing with chromic gut, silk, or silkworm-gut,



Fig. 4089.—The Same – III; – Closure of the lumbar wound and anchorage of the colonic anus. Course of the descending colon is seen – in connection with the ribs above, and the iliac crest below – the patient being in the operating position. (Note: The descending colon is directed too far forward in its upper part – see Landmarks.)

leaving just space enough for the emergence of the gut. The convex dome of the bowel is sutured into the lips of wound – by interrupted sutures of silk passing through the fibrous and muscular coats of the intestine, on the one hand, and the skin of the abdomen, or as near it as possible, on the other.

If haste be unnecessary – several days are allowed to pass for union of intestine to abdominal wound to occur, and then the intestine is incised and the lips of the intestinal wound sutured to the lips of the abdominal wound – by interrupted sutures of silk passing through all the coats of the bowel, and through the skin of the lumbar region, or as near it as possible – the sutures being passed from the skin into the gut (making infection less likely) – (Fig. 4089). If haste be necessary – the above incision is made at once. If a tem-

porary fecal fistula be intended _ the gut is incised in its longitudinal axis. If a permanent artificial anus be intended _ the gut is drawn as far into the wound as possible (which is never as far as in the anterior operation) and divided nearly through _ the object being to form a partial spur as in the anterior operation.

Comment.—The outer border of the erector spinæ is the superficial muscular guide to the colon. The outer border of the quadratus lumborum may be cut to expose the colon if necessary. The operation is difficult in very thick loins _ thorough retraction aids the steps.

It is important to recognize and open up the transversalis fascia _ and not mistake it for the peritoneum. The bulging peritoneum has been mistaken for the colon. The duodenum has been mistaken for the ascending colon in operating on the right side _ and the stomach for the descending colon in operating on the left side. The kidneys and small intestine have been mistaken for the colon. The small intestine, when encountered, lies external to the colon, The colon is generally distinguished by its longitudinal bands, anterior, posterior (at the mesocolon, when the mesentery is present), and one internal, _ by its greater fixity, _ and by its sacculations (often filled with scybala). The descending colon is sometimes congenitally absent. The large intestine may be distended with air or water to aid its recognition. The empty colon is often hard to detect. If all means of detection fail, do a median abdominal section _ find the bowel _ and then complete the lumbar operation.

If the peritoneum be accidently opened, close it by gut suture if possible. If this cannot be accomplished, no harm is generally done by accidentally opening the peritoneum in this locality. Draw the intestine into the wound and fix it there.

If the mesocolon be present, the abdominal cavity must be opened, unless the laminæ of the mesentery can be split _ which can generally be done. (See Fig. 4085.) A branch of the inferior mesenteric artery may guide to a separation of the laminæ.

The non-peritoneal surface of the colon is generally thickly covered with fatty areolar tissue _ which also intervenes between the colon, in front, and kidney, diaphragmatic crura, and quadratus lumborum, behind.

The empty descending colon is apt to tend further toward the median line, behind the border of the quadratus lumborum, than a distended one _ so that, in such cases, the normal site of the distended colon is more apt to be occupied by peritoneum, which is consequently, under these circumstances, more apt to be opened.

Owing to the fixity of the colon it is often hard to get enough of it into the wound to form a spur, in the operation for artificial anus _ though enough for a fecal fistula is generally to be gotten. If difficulty be experienced in causing sufficient bowel to protrude, a Paul tube may be tied into the gut, and the ends of the wound being closed about it.

Right lumbar colostomy may be performed when anterior cecostomy is impossible in unusual cases.

OPERATION FOR PROLAPSED HEPATIC FLEXURE OF THE COLON

Prolapse of the hepatic flexure of the colon and of the right kidney are apt to be encountered together _ and in the operation for the fixation of the kidney by lumbar incision (v. Index), the peritoneum is opened through the same wound, as the kidney is exposed and the hepatic flexure fixed by suture _ aided by the fixation of the omentum, near the hepatic flexure, through the lumbar wound.

OPERATION FOR PROLAPSED TRANSVERSE COLON

The two most usual forms of prolapsed, or ptosed transverse colon, are the loop of V-form, and the M-form. Several methods of fixation have been employed. The transverse colon has been sutured to the greater curvature of the stomach (Payr), the transverse mesocolon has been reefed, by sutures, just as is sometimes applied to the gastrohepatic omentum in gastroptosis (Bier), and the transverse colon has been sutured to the inner aspect of the anterior abdominal wall.

SIGMOIDOPEXY, OR COLOPEXY OF THE SIGMOID LOOP

BY FIXATION TO THE ANTERIOR ABDOMINAL WALL (BRYANT'S OPERATION)

Description.—Colopexy, or the fixation of some part of the colon to some aspect of the abdominal wall, is performed for abnormal mobility of either the

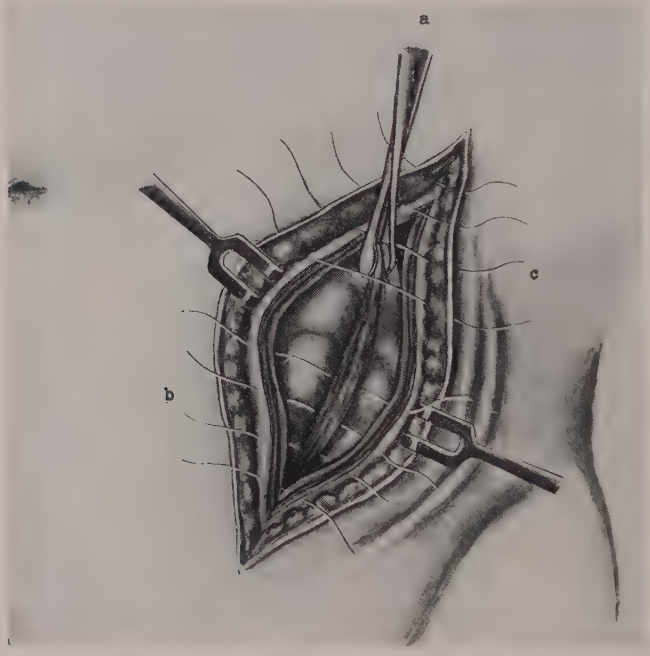


Fig. 4090.—Sigmoidopexy by Fixation to the Anterior Abdominal Wall: a, Traction forceps drawing the free portion of the sigmoid toward the upper end of the wound, and holding the intestine in contact with the abdominal wall; b, anchoring sutures passing through the longitudinal band of sigmoid and through the abdominal musculature; c, superficial sutures.

transverse colon, sigmoid colon, or rectum. The portion of the colon usually fixed is the sigmoid loop and the condition for which this is usually carried out is either unusual mobility of the sigmoid or prolapse of the rectum generally the latter. The operation of sigmoidopexy, about to be described, for prolapsus recti, consists in drawing the rectum and sigmoid taut, in an upward direction, between the anus and the abdominal wound, and then anchoring the sigmoid to the anterior abdominal wall first, by stitches which attach the marginally detached parietal peritoneum to the outer walls of the colon and then by stitches which include the borders of the main wound and the longitudinal coat of the colon.

Preparation _ Position.—As for median abdominal section.

Landmarks.—Outer part of Poupart's ligament.

Incision.—About 7.5 cm. (3 inches) _ parallel with and about 2.5 cm. (1 inch) above the outer part of Poupart's ligament _ being extended upward if more room be necessary.

Operation.—The above incision is carried intramuscularly down to and through the peritoneum _ clamping and tying any bleeding vessels encountered. After having opened the abdominal cavity, the parietal peritoneum is separated from the edges of the abdominal wound for about 2.5 cm. (1 inch) on each side, the width of separation being somewhat greater above than below _ the separated peritoneum thus forming two flaps. The rectum is now pulled well upward, reducing all prolapse _ and, at the same time, any adjacent

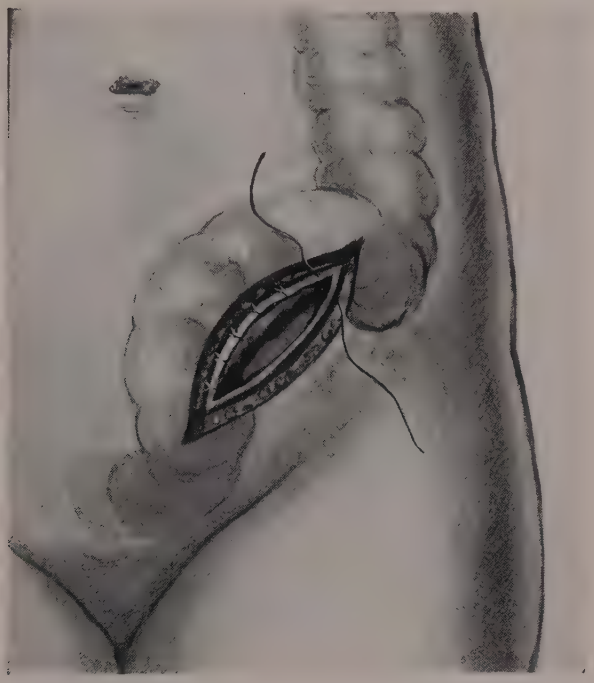


Fig. 4091.—Sigmoidopexy; _ Sutures are seen anchoring the mesentery of the colon to the peritoneally covered abdominal wall near the wound margin _ and other sutures in the act of closing the depths of the abdominal wound.

laxity of the colon is pulled down. While the rectum is being drawn firmly upward, the parietal peritoneal flaps are sutured to the serous and muscular coats of the rectum by quilting or continuous chromic catgut sutures (Fig. 4090). About half a dozen silk sutures are then passed in the following order _ through all the layers of the edges of the abdominal wound _ through the peritoneal flap of that side _ then through the serous and muscular coats of the intestine passing behind the longitudinal band _ out through the peritoneal flap of the opposite side _ and then through all the tissues of the corresponding edge of the abdominal wound. These deep sutures are then drawn tight and tied _ thus bringing the longitudinal band and a part of the intestinal wall into contact with the abdominal wall _ and approximating the borders of the wound so that they grasp the longitudinal band and part of the wall of the gut _ and,

at the same time, closing the abdominal wound. The stitches through the borders of the abdominal wound also serve to reapproximate the marginally separated flaps of parietal peritoneum to the abdominal wall.

Comments.—The mesentery of the sigmoid is sometimes sutured to the peritoneally covered abdominal wall as anchorage (Fig. 4091).

SIGMOIDOPEXY—BY SUBPERITONEAL FIXATION TO THE POSTERIOR ABDOMINAL WALL

MURPHY'S OPERATION

Description.—A loop of the relaxed sigmoid is placed in a partial pocket of peritoneum, made by detaching the parietal peritoneum from the psoas muscle, to the outer side of the ureter _ after which the fold of parietal peritoneum is sutured over the loop. The operation is usually resorted to for prolapse of the rectum or displacement of the sigmoid.

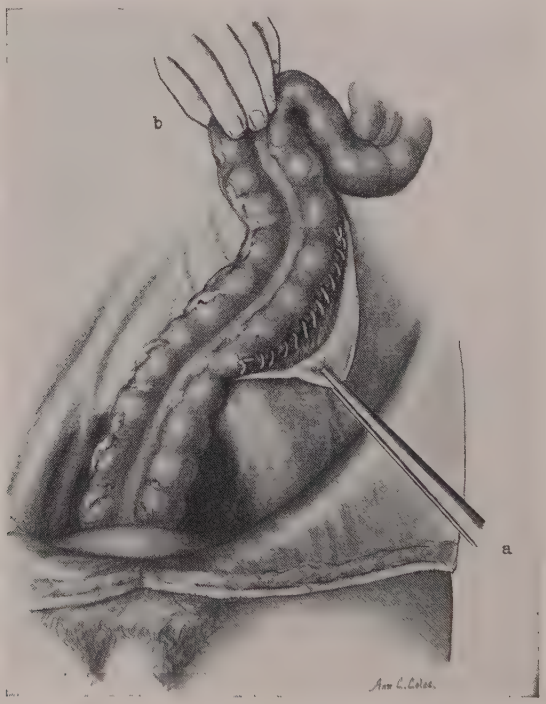


Fig. 4092.—Murphy's Subperitoneal Sigmoidopexy for Prolapsus Recti _ I: _ a, Peritoneal flap turned back from the border of the pelvis, external to the ureter; _ b, traction being exercised to straighten the prolapsed sigmoid and rectum, the outer border of which is then sutured, in curvilinear fashion, to the denuded muscles by continuous suture. Note: The picture should show the patient in the Trendelenburg position. View it in inverted position. (Figs. 4092–4094 modified from Murphy.)

Operation.—With the patient in the Trendelenburg position, the abdomen is opened by a vertical incision over the outer aspect of the left rectus muscle, reaching nearly to the pubis, followed by the inward retraction of its outer border, and incision of its posterior sheath, the transversalis fascia, and peritoneum.

The sigmoid is caught with intestinal forceps and drawn upward, and, with it, the rectum, until the latter is under reasonable tension _ to calculate the amount of redundancy. An incision, about 12.7 cm. (5 inches) in length,



Fig. 4093.—The Same – II; – The loop of the sigmoid is now covered, pocketed, as it were, by the mobilized flap of parietal peritoneum, the free margin of which is sutured to the normally attached peritoneum and to the peritoneal aspect of the sigmoid. See note in legend of Fig. 4092.

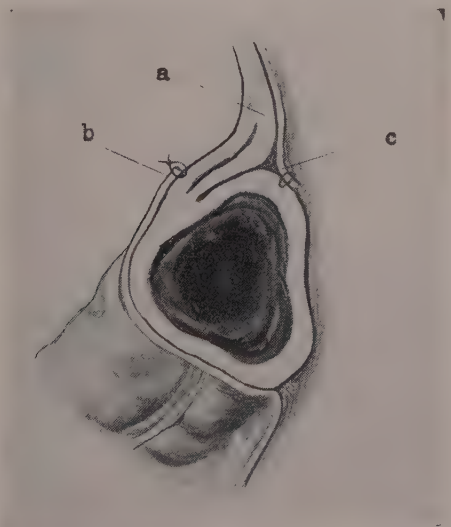


Fig. 4094.—Murphy's Subperitoneal Sigmoidopexy for Prolapsed Rectum – III: – a, Mesosigmoid; – b, reflected fold of peritoneum sutured over the sigmoid, to the wall of the sigmoid, or to the inner leaflet of the mesosigmoid and pelvic peritoneum; – c, inner aspect of unfreed peritoneum sutured to the wall of the sigmoid. See note in legend of Fig. 4092.

is then made through the posterior parietal peritoneum, beginning at the rim of the pelvis and extending upward, to the outer side of the left ureter. This peritoneal flap is then freed, by blunt dissection, in an outward direction (Fig. 4092). The loop of sigmoid is now placed within this pocket, bounded by denuded muscle posteriorly, and made of peritoneum anteriorly _ and the peritoneal flap is then drawn inward over the sigmoid and sutured to the muscle and to the line of main peritoneum from which it has been cut, as well as to the sigmoid over which it lies (Fig. 4093). The details of the peritoneal suturing are shown in Fig. 4094. Adhesions form between the peritoneal surfaces and the raw surfaces, holding the parts in place. The abdomen is closed in the usual way.

SIGMOIDOPEXY—BY FIXATION TO THE DENUDED POSTERIOR ABDOMINAL WALL

BALL'S OPERATION

Description.—This procedure is very similar to Murphy's operation just described _ except that while the sigmoid is sutured to the denuded

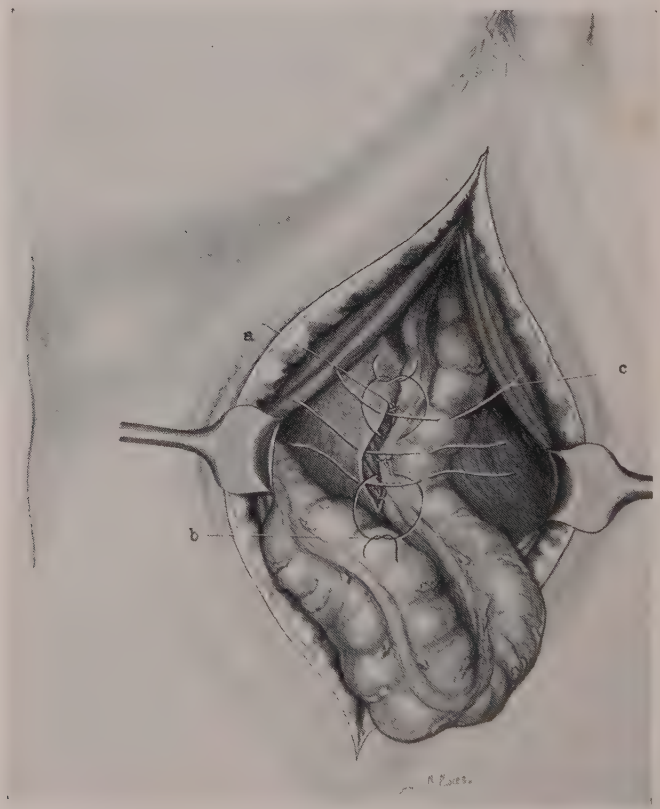


Fig. 4095.—Sigmoidopexy for Prolapsus Recti _ I; _ Patient in marked Trendelenburg position _ incision through the separated fibers of the left rectus. The sigmoid loop is drawn well cephalad _ and is then anchored to an oval denudation of the iliac fascia between the brim and the crest of the ilium by three rows of sutures: _ **a,** Sutures through the inner margin of the peritoneal incision, to the interval between the colonic mesentery and its postero-external tenia; _ **b,** sutures of postero-external tenia to the iliac fascia and muscle; _ **c,** sutures through the outer margin of the peritoneal incision to the colonic serosa outside of the postero-external tenia. (Figs. 4095 and 4096, modified from Ball.)

muscle tissue of the posterior iliac region no fold of peritoneum is sutured over it.

Operation.—The patient is placed in a Trendelenburg position which is somewhat higher than usual – after which the abdomen is opened by a vertical incision splitting the left rectus muscle – and the sigmoid colon drawn upward until all prolapse of the rectum and of itself is reduced. A vertical incision of about 6.2 cm. (2½ inches) in length is then made through the pelvic parietal peritoneum, parallel with but lying to the outer side of the left ureter, followed by the retraction of its margins, exposing the denuded iliac fascia. The sigmoid colon is now somewhat tautened as it is brought into apposition with this denuded surface, while held in such position that one of its muscular bands rests upon the raw iliac fascia (Fig. 4095) – and the inner edge of the freed parietal peritoneum is sutured with fine silk to the outer coats of the sigmoid, between its muscular band and the mesenteric attachment (Figs. 4095 and 4096, **c**). Four thicker silk sutures are next passed into the muscular band of the sigmoid (Figs. 4095 and 4096, **b**), without penetrating into

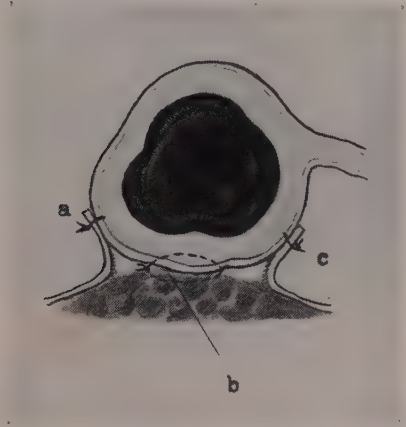


Fig. 4096.—The Same – II; – Structures seen in cross-section – the lettering being the same as in the preceding.

the lumen, and into the iliac fascia and underlying muscle, sufficiently to get a good hold, and are then tied and cut short. Finally, the outer margin of detached peritoneum is sutured by fine silk to the outer wall of the sigmoid, external to the longitudinal muscular band (Figs. 4095 and 4096, **a**).

The abdomen is closed by tier suturing.

REEFING OF AN ABNORMALLY LONG MESOSIGMOID FOR THE PREVENTION OF VOLVULUS OF THE SIGMOID

The presence of an unusually long mesentery of the sigmoid colon makes more likely the occurrence of axial twists in this part of the large intestine, furnishing freer play to the part than ordinarily exists. This excess of mesentery may be shortened by a process of reefing, or pleating – by placing several more or less parallel, or somewhat diverging rows of sutures through the mesentery, being careful not to seriously interfere with the blood-supply of the parts. The technic is indicated in Fig. 4097.

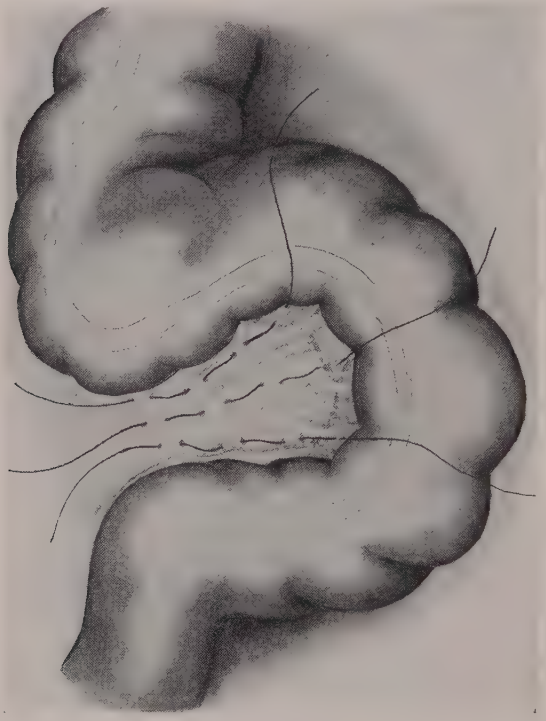


Fig. 4097.—Reefing of an Abnormally Long Mesosigmoid for the Prevention of Volvulus of the Sigmoid.

COLOPLICATION FOR MEGACOLON

Congenital dilatation of the colon is a characteristic feature of Hirschsprung's disease, and one of the means of dealing with this condition con-

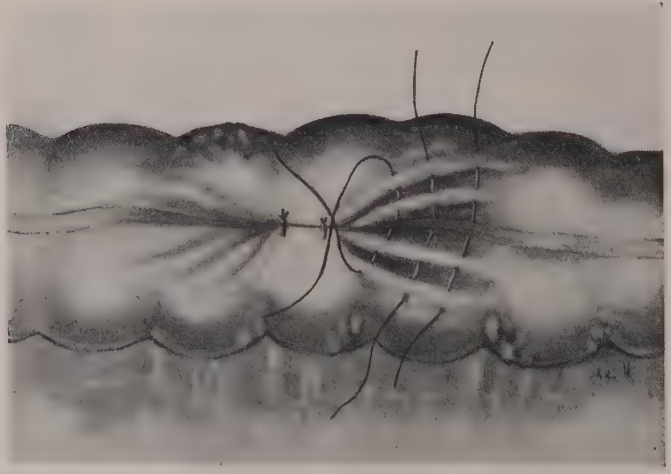


Fig. 4098.—Coloplication for Megacolon; The antimesenteric aspect of the sigmoid is being pleated, with frequently re-entrant interrupted sutures, for the purpose of narrowing the caliber of the abnormally large bowel.

sists in pleating a part of the colonic wall upon itself sufficiently to reduce the caliber of the large bowel. Two, three, or more axial tiers of suturing are applied in such a way as to infold the wall of the bowel upon itself, and,

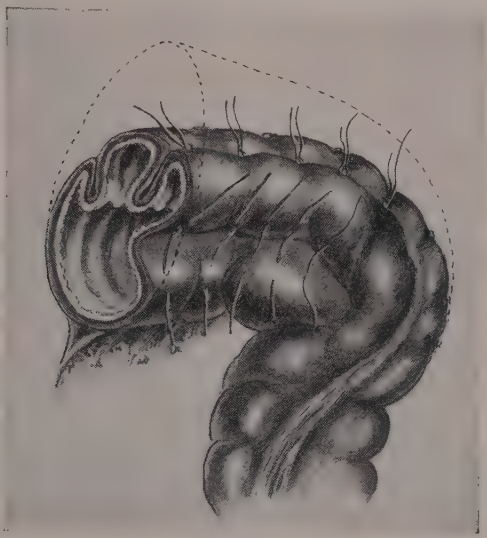


Fig. 4099.—Coloplication for Megacolon (Sectional View); – The dilated colon (represented by dotted lines) is pleated with interrupted sutures, upon and within itself, in longitudinal folds, along one, two, or three axial lines, as indicated by its size – the pleats being held in position by Lembert sutures. (Modified from Gant.)

at the same time, to bury these folds within the general contour of the narrowed bowel. A surface view of the procedure is shown in Fig. 4098 – and a side view in Fig. 4099.

OPERATION FOR MEMBRANOUS PERICOLITIS

("JACKSON'S MEMBRANE")

This is a condition of peritoneal adhesions about the colon somewhat similar to the ileocecal adhesions and kinks ("Lane's kinks") already mentioned in connection with the ileocecal region (Vol. IV, p. 779).

Jackson's description of the condition is as follows: – "From a point just at the hepatic flexure, to 3 inches above the caput, there spreads from the parietal margin over the external lateral margin to the internal longitudinal muscle band, a thin, vascular veil, in which long, straight, unbranching blood-vessels course, most of which are parallel with each other and take a slight spiral direction over the colon from the outer upper peritoneal attachment to the inner lower portion of the gut, ending just above the caput. The appendix is not implicated in any way. Coursing with the blood-vessels are numerous shining narrow bands of connective tissue, which gradually broaden as they go, and end in a slight fan-shaped attachment at various points on the anterior and inner surface of the colon. At these points of attachment the gut is held in rigid plication."

These bands vary in density and strength – and when they are divided the intestinal plications disappear and the bowel unfolds, assuming its natural appearance.

The operative relief of the condition consists in the division and excision of the bands of adhesion.

PARTIAL EXCLUSION OF THE LARGE INTESTINE BY ILEOSIGMOIDOSTOMY, WITHOUT EXCISION AND WITHOUT COLOSTOMY

Description.—The ileum, just proximal to the cecum, is here anastomosed with the sigmoid flexure _ so that the major portion of the bowel contents pass from the ileum to the sigmoid, short-circuiting the large intestine. No part of the large intestine is excised. If there be no question of the adequacy of drainage of the large bowel, thus short-circuited, no additional opening (colostomy) of the large bowel is required, as its means of emptying is left just as it was before the ileosigmoidostomy, which has simply been added to it _ but if, as so often happens, the large intestine is so blocked by the very condition which called for the ileosigmoidostomy (v. i.) as to interfere with the satisfactory fecal circulation of this part, now limited in function, then it becomes necessary to provide, by a colostomy opening, a separate



Fig. 4100.—Partial Exclusion of the Large Intestine by Ileosigmoidostomy, Without Excision and Without Colostomy.

escape for even the limited contents of the short-circuited portion of the large intestine.

The performance of ileosigmoidostomy may be called for in such conditions as Hirschsprung's disease (congenital hypertrophic dilatation of the colon), in Lane's operation for chronic obstipation, in extensive inoperable tumor involvement, and the like.

The principles and details of Intestinal Exclusion, or Occlusion, have been given and illustrated in Vol. IV, p. 757.

The general appearance of the parts following the accomplishment of an ileosigmoidostomy are seen in Fig. 4100.

TOTAL EXCLUSION OF THE LARGE INTESTINE, BY LOWER ILEOSTOMY AND DESCENDING COLOSTOMY, FOLLOWED BY ILEORECTOSTOMY

Description.—The entire large bowel is short-circuited and rendered functionless _ provision being made for its external drainage at both ends _ after which the ileum is anastomosed with the lower portion of the sigmoid (or first part of the rectum).

The ileum is severed at about 10 cm. (4 inches) from the cecum, after which the distal end of the ileum is brought out through the right inguinal region by an intramuscular operation, constituting a right inguinal ileostomy. The lower portion of the sigmoid is divided, and its proximal end brought through the left inguinal region by an intramuscular operation, constituting a left inguinal sigmoidostomy. The proximal end of the severed ileum is then anastomosed with the distal end of the severed sigmoid, forming an ileosigmoidostomy (which may be either an end-to-end anastomosis, or, after closing the ends of ileum and sigmoid, a side-to-side anastomosis). The entire technic is indicated in Fig. 4101.

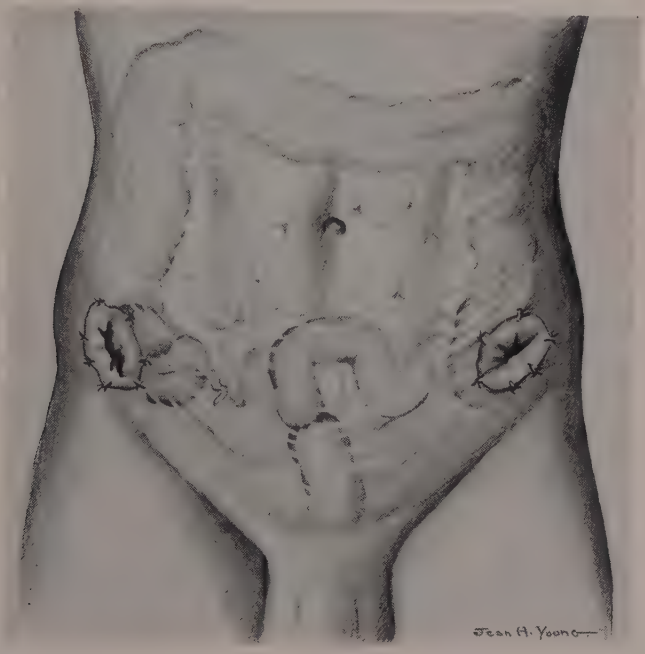


Fig. 4101.—Total Exclusion of the Large Intestine by Lower Ileostomy and Descending Colostomy, Followed by Ileorectostomy.

This extensive procedure may be resorted to as an alternative to the even more extensive operation of excising the entire large intestine _ and may be employed in marked intestinal stasis _ or in more marked states of the same conditions for which the operation just preceding is performed.

EXCLUSION OF THE LARGE INTESTINE BY ILEOSIGMOIDOSTOMY OR ILEORECTOSTOMY—WITHOUT DIVISION OR EXCISION

The entire large intestine is sometimes short-circuited without section of any part of the tract. The operation is occasionally performed in chronic constipation (Lane), and in Hirschsprung's disease (chronic hypertrophic dilatation of the large intestine) _ as well as in extensive or inoperable malignant or tubercular involvement of the large bowel. Ileorectostomy is more particularly resorted to where the small intestine is adherent to the pelvic colon, deep down in the true pelvis.

The general features of intestinal exclusion or occlusion have been described and pictured (Vol. IV, p. 757).

A convenient loop of the ileum, near its junction with the cecum, is chosen, and its antimesenteric aspect is isoperistaltically and laterally anastomed with the anterior band of the sigmoid colon. This entero-anastomosis may be accomplished by ordinary suturing _ or may be brought about by the Murphy button, _ the half-button in the ileum being introduced in the usual way, and the half-button for the sigmoid may be inserted into the large bowel either in the usual manner or may be carried up the rectum, through the anus, held in the clasp of long forceps, and then cut down upon when *in situ* opposite the male half of the button.

Ileocolostomy (between the end or side of the lower ileum and the transverse colon) _ or colosigmoidostomy (between the transverse colon and the sigmoid) may also be performed _ where less than the whole of the large intestine is to be excluded.

TRANSPERITONEAL SIGMOIDOTOMY FOR THE REMOVAL OF TUMORS OF THE SIGMOIDAL OR RETROSIGMOIDAL MUCOSA

MAYO'S TECHNIC

Description.—William J. Mayo has resorted to this procedure for the removal of adenomatous, papillomatous, or fibrous tumors of the sigmoidal or rectosigmoidal mucosa _ a group of conditions which, if discovered and removed early, may spare the patient the considerably increased chance of having to submit to a much more hopeless operation for malignancy later on _ as is frequently experienced in polyposis, and in allied pathologic involvements. He suggests that in some cases where a partial colectomy might seem indicated in polyposis, that trial first be made of performing an ileostomy, and delay for about six months, or more, during which time the large intestine is at rest _ in the meantime, removing the polyps from the rectum and lower sigmoid. In several patients with whom this course was pursued the ileum was reimplanted in the colon. Otherwise, colectomy may be done as an alternative measure.

The rectosigmoid is the constricted portion of the large bowel which corresponds with the 9 cm. ($3\frac{1}{2}$ inches) made up of the lower 5 cm. (2 inches) of the sigmoid, and the upper 3.8 cm. ($1\frac{1}{2}$ inches) of the rectum. It may be both difficult and dangerous to undertake to remove tumors of the lower sigmoid through the sigmoidoscope, especially since these tumors are often sessile, instead of pediculated.

Operation.—The patient may be advantageously placed in a moderate Trendelenburg position (especially avoiding the exaggerated position in old and fat individuals). The abdomen is opened by a median suprapubic incision _ and the margins of the wound held apart by a Balfour self-retaining speculum. Having brought the sigmoid into the field, an axial incision is made through its anterior longitudinal band _ planning as well as possible that the center of the incision fall over the tumor. The margins of the intestinal wound are drawn apart and the tumor delivered outside of the intestinal lumen _ after which two clamps are applied, and the tumor removed by the cautery (Fig. 4102). While the lower clamp still remains in position, the margins of the intestinal mucosa, from which the tumor was removed, are sutured, in the continuous overhand fashion which Pilcher applies to the excision of hemorrhoids with chromic catgut (Fig. 4103). The margins of the incised sigmoid are then brought together by continuous through-and-through catgut sutures _ reinforced by fine silk Lemberts. Finally, a red rubber rectal tube is passed from the anus on up beyond the site of the intrasigmoidal suturing, to relieve gas distention _ the tube being stitched to the anal orifice.

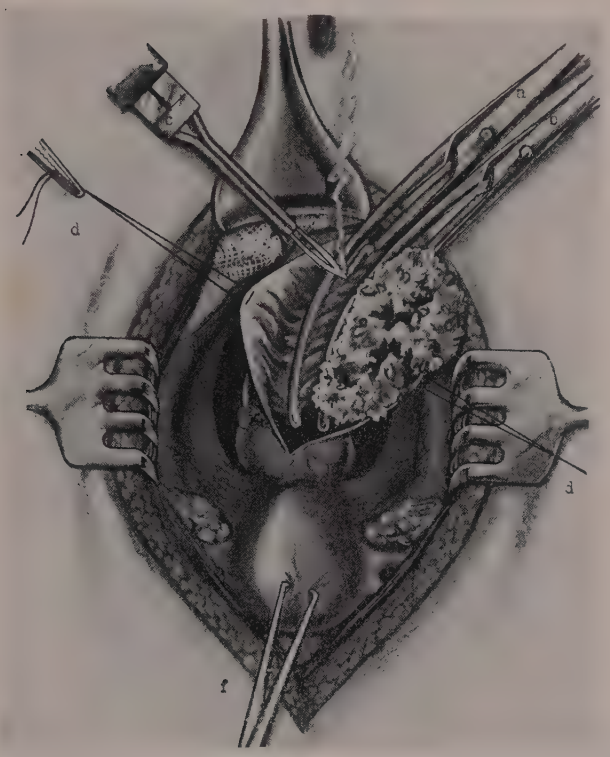


Fig. 4102.—Transperitoneal Sigmoidotomy for the Removal of Tumors of the Sigmoidal or Rectosigmoidal Mucosa _ Mayo's Technic _ I; _ The sigmoid has been exposed, incised, and the papillomatous mass delivered outside of its lumen _ after which it is doubly clamped and excised by cautery section between the clamps.

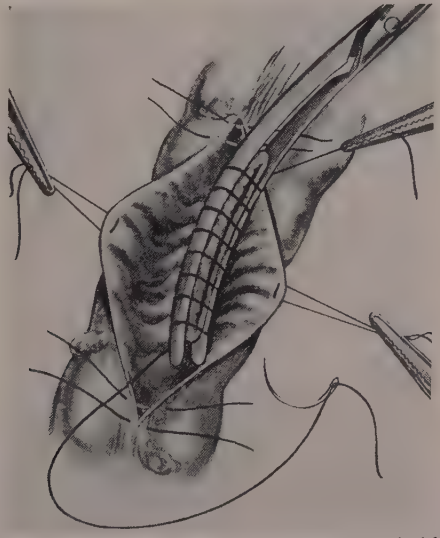


Fig. 4103.—The Same _ II; _ Suturing the divided mucosa in the tumor bed by Pilcher's method. The sigmoidal opening will be closed by a double tier of sutures.

Comment.—It is understood that this procedure is not applied to cases where undoubted, or reasonably certain, malignancy exists.

EXCISIONS OF THE COLON, IN GENERAL

Chief Indications for Excising Parts of the Colon.—Foremost among the pathologic conditions for which the various portions of the large bowel are excised is malignancy. Other conditions are: volvulus, intussusception, tuberculosis, extensive adhesions in complication with tumors, and in some cases of marked chronic constipation.

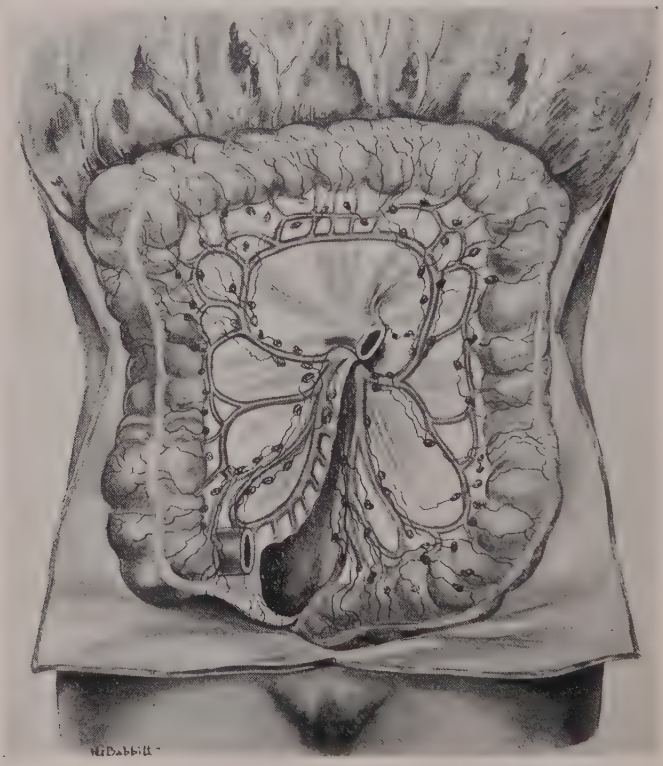


Fig. 4104.—The Vascular and Lymphatic Distributions to the Large Intestine; – Showing the superior mesenteric, ileocolic, right colic, middle colic, inferior mesenteric, left colic, sigmoid, and superior hemorrhoidal arteries. The main lymphatic groups are seen along the ileocolic, middle colic, left colic, and inferior mesenteric vessels. The subgroup of lymphatics are the epicolic, paracolic, intermediate, and main, lying as their names indicate (and as further described in the text). These vascular and lymphatic distributions are of great practical importance in planning excisions of parts of the colonic tract.

In connection with malignancy an operation may be performed for malignancy, *per se* – or for the most usual result of malignancy, obstruction. It is the former of these which should always be the aim – the Surgeon's action then being one of choice, following an early and clever diagnosis – rather than the belated and compulsory effort to relieve a malignant obstruction which has almost certainly passed beyond the confines of the intestine, usually resulting in an operation merely of palliation.

Of importance almost, or quite as great as that of removing the focus of

the disease itself, is the removal of the lymphatic tract which drains the area of primary disease. Unless this be done the operation cannot be considered radical.

Vascular Distribution of the Colon (Fig. 4104).—The distribution of the vessels to the parts of the colon plays an unusually important rôle in operating upon this structure. Indeed, it may be said, practically, that the distribution of the vessels determine the lines of excision of the bowel — for the loss of a main artery of the colonic region reduces the blood-supply of a definite area of the colon below the point of safety to the nourishment of that area. For instance, having decided upon the ligation of the middle colic artery, enough of the ascending colon, to the right, must be excised to insure a sufficient blood-supply from the right colic artery to the remaining portion — and enough of the transverse colon, to the left, must be removed to provide ample nutrition from the left colic artery to the balance of the transverse colon.

Lymphatic Distribution of the Colon.—The importance of knowledge as to the lymphatic distribution is of practical value, for, in operating for malignancy, removal of the lymphatic drains of the tissues primarily involved is quite as important as the removal of the involved site itself — indeed, without it, the removal of the growth itself is frequently useless. Fortunately, malignancies of the colon are usually confined to the bowel itself, for a longer period before secondary deposits occur, than is characteristic of malignancy in many other localities — thus bringing ample reward and an easier operation to the early diagnostician and prompt operator — not to mention the patient.

The subject of the colonic lymphatic distribution has been painstakingly worked out by Jamieson and Dobson — and the results turned to very practical account — of which the salient feature is, that the lymphatics of the large bowel correspond, in very large part, with the course of the main blood-vessels of the parts — so that the blood-vessels become, largely, a guide in determining the amount and position of the segments of the colon to be removed in a two-fold sense, — first, by showing where the lines of excision must fall, in order that the remaining ends of the colon may be assured of sufficient blood-supply for nourishment — and, second, by showing where the main lymphatics of the excised part of bowel are to be sought for their removal. The main lines of lymphatic vessels and glands lie along the ileocolic, middle colic, left colic, and inferior mesenteric vessels — no definite grouping of lymphatics being allotted to the less regular right colic vessels. In addition to this main grouping of the lymphatics, each of the colonic areas present four subgroupings of the lymphatic glands, which intercommunicate with each other, namely — epicolic glands (in the epiploic appendices, upon the intestinal walls) — paracolic glands (lying between the bowel and the arterial loops, paralleling the border of the mesentery) — intermediate glands (grouped about the arteries, at about middistance between the source of the vessels and the intestine, receiving vessels chiefly from the epicolic and paracolic groups, and sometimes from the intestine itself) — main glands (grouped about the origin of the chief arterial trunk and receiving vessels from the other three outlying groups, and, themselves, emptying into the mesenteric and lumbar glands).

The lymphatic distribution may be tabulated as follows:

(*A*) **Main Lymphatic Groups, Corresponding with the Main Colonic Blood-vessels:** —

(*a*) Ileocolic.
(*b*) Middle colic.
(*c*) Left colic.
(*d*) Inferior mesenteric.

(*B*) **Subgrouping of Each Main Lymphatic Group, Based on Position:**—

(*a*) Epicolic.
(*b*) Paracolic.
(*c*) Intermediate.
(*d*) Main.

Generalizations.—In calculating that the blood-supply of a segment to be involved in excisions of the colon will not be interfered with, the problem will be simpler where the segment is supplied by a single vessel, other than by anastomoses from two sources—which is more marked at the flexures of the colon.

The final supply of the individual segments of the colon come from the primary arterial loops beneath them, but these, in turn, come, of course, from the main arteries of the part. A study of the part will show (v. Fig. 4104) that if the ligation of a main vessel will cut off the primary arterial loops of the bowel segment, it must not be tied, or a different division of the bowel be made—yet that, nevertheless, if these primary loops are strongly anastomosed by the next adjacent main artery, vitality may still be assured. No doubtful risk, nevertheless, should be taken.

Adhesions of the parts and infiltration of the pathologic process are the two chief obstacles to successful radical operation for malignancy of the colon.

A very large number of patients suffering from cancer of the colon die from intestinal obstruction by the growth, before lymphatic infiltration outside of the area has occurred, as compared with cancer elsewhere—which fact emphasizes the desirability of early diagnosis and early operation—and the favorable outlook of such early operations.

While the extra-intestinal glands first most frequently involved are those nearest the bowel, such as the paracolic, yet this is not necessarily so, as the intermediate lymphatic glands may be found enlarged, because of their direct connection, while the paracolic may not be involved. When this is the case, without involvement of the connecting lymphatic vessels, Jamieson and Dobson concluded that this occurred through embolism, rather than by infiltration, or permeation.

The feasibility of radical operation in advanced cases will be determined, largely, by the groups of lymphatics involved—involvement of the intermediate group being, as a rule, the outside limit—and involvement of the main group, contraindicative.

Glands are sought in the retroperitoneal tissues along the course of the vessels.

It makes very considerable differences whether the operation for cancer of parts of the colon be performed before or after intestinal obstruction has taken place—of first importance to the patient, and of considerable importance to the Surgeon, from the standpoints of ease and thoroughness in the doing of the operation.

Operations for the excision of parts of the colonic tract fall within two general groups,—(*a*) Primary Operations—in which the segment of bowel is excised, and the remaining tract reconstructed immediately after—constituting the type of operation applicable to tumors of the large intestine discovered early in their history, and before bowel obstruction has occurred and structural change in the intestine has made any progress—no operative step preceding the single step radical operation,—(*b*) Combined Preliminary and Secondary Operations—in which, chiefly owing to obstruction of the intestine by the growth, as well as modifications of the bowel and surroundings because

of progress in the disease, and constitutional involvement of the patient, no immediate radical operation can be wisely performed.

A series of primary operations for excision of the different parts of the colon will be first considered, as applied to early cases, without obstruction, or other radical complications. In this the technic worked out by Jamieson and Dobson, especially in connection with the lymphatic distribution, will be largely followed.

Then will follow types of combined preliminary and secondary operations, applicable to cases in which bowel obstruction, or other complications, are present _ such as the two- and three-stage operations.

Finally, there might be grouped a category of operative procedures not strictly coming within either of the above _ such as combined excision and artificial anus.

EXCISION OF THE CECUM, TOGETHER WITH THE ADJACENT PARTS OF THE ILEUM AND ASCENDING COLON, FOLLOWED BY ILEOCOLOSTOMY

This procedure is described in Vol. IV, p. 812.

EXCISION OF THE HEPATIC FLEXURE OF THE COLON (INCLUDING THE DISTAL HALF OF THE ASCENDING COLON AND PROXIMAL TWO-THIRDS OF THE TRANSVERSE COLON)—FOLLOWED BY LATERAL COLOCOLOSTOMY—(OR BY ILEOSIGMOIDOSTOMY, WITH EXCLUSION OF THE CECUM—OR BY ILEOCOLOSTOMY, AFTER EXCISION OF THE CECUM)

Description.—It will be seen that the excision here represents and is determined by the distribution of the middle colic artery and vein, and their accompanying lymphatic vessels and glands _ as shown in Fig. 4104 _ the lines of section of the ascending colon and of the transverse colon being left supplied, respectively, by the right colic and left colic arteries.

Following the excision of the parts of the large intestine mentioned, the intestinal continuity may be established in one of several ways: _ (*a*) By invagination of the ends of the ascending and transverse colons, and their lateral anastomosis. This is the most desirable method, and is mentioned by some Surgeons as the routine measure (while not mentioned at all by others), but it seems to the Author that it must frequently be impossible, especially in the class of cases in which the operation is applied, to span the gap between the two divided ends, for an attempt at an end-to-end anastomosis (even if that were wise), to say nothing of the much greater length of intestine required to invaginate both ends of the colon, plus the still additional length for a lateral type of anastomosis; _ (*b*) By ileosigmoidostomy _ which necessitates practically a total exclusion of the cecum and beginning of the ascending colon, whether it were a side-to-side or end-to-side ileosigmoidostomy (as the anastomosis would be on the proximal side of the valve of Bauhin, and therefore on the reverse side to the normal intestinal flow) _ and, further, would involve a partial exclusion of the remnant of the transverse and descending colons; _ (*c*) By ileocolostomy, after excising, as a further step, the distal end of the ileum, the cecum, and the remnant of ascending colon _ which is an extension of the same technic described in the excision of the cecum (Vol. IV, p. 812).

Preparation _ Position _ Landmarks.—As for right paramedian abdominal section.

Incision.—A vertical incision is made through the outer part of the right rectus muscle, or at its outer border, with the middle of the incision corresponding with the level of the umbilicus _ and of sufficient length for the ex-

tensive manipulation involved — the site of operation being brought further forward by the patient resting upon a lumbar support.

Operation.—On opening the abdomen in the above line, a thorough examination is made as to the nature and extent of the condition, usually tumor, for which the operation is performed — of the surrounding adhesions, if any — and especially as to the presence or absence of lymphatic involvement (and, if present, its distribution and extent) — and if the lymphatics have become involved, for visceral metastases.

Having drawn the transverse colon out of the wound, packed off the field from the general cavity, especially upon its inner and lower aspects, and exposed the transverse mesocolon, the middle colic artery and vein are ligated near their origin from the superior mesenteric (between the folds of the transverse mesocolon, about on a level with the beginning of the third, or transverse part of the duodenum). This is the important initial step to the divisions of the bowel.

The division of the middle of the ascending colon is accomplished by drawing the ascending colon toward the middle line, tensing the reflection of peritoneum from this part of the colon, on to the posterior abdominal wall, and beginning the section of the peritoneum, with Mayo scissors, between the cecum and the middle of the ascending colon. Cutting upward in this line, the peritoneum is divided external to its reflection from and parallel with the ascending colon and hepatic flexure. The ascending colon and hepatic flexure are then freed from the abdominal wall by blunt dissection, preferably by the finger, carried behind them, and drawn inward. In this separation of the bowel one should especially guard the ureter, as it passes obliquely downward and inward, across the psoas muscle, and the spermatic vessels, crossing the ureter obliquely downward and outward. When the colon and hepatic flexure have been displaced inward, they are further completely freed by cutting the upper fold of the transverse mesocolon as it passes anterior to the second part of the duodenum, as, at this stage, it is rendered readily accessible — thus enabling the hepatic flexure and the adjacent portions of ascending and transverse colons to be freely mobilized and exposed in the wound. Two clamps are then applied, one on each side of the middle of the ascending colon, where its section is to be made. It is important to plan the division safely within the region supplied by the right colic artery, that no terminal necrosis may occur. Following transverse division of the middle of the ascending colon, the proximal end is surrounded with gauze and clamped, and the distal end is invaginated by a double tier of sutures. Following up the inner aspect of the bowel, the parietal peritoneum is severed along its reflection on to the colon — the mesocolon being divided between the section of the colon and the site of ligation of the middle colic artery — all bleeding vessels encountered being tied with fine chromic catgut. All enlarged lymphatics are carefully sought for and removed.

While the site of division of the transverse colon is generally where the middle and outer thirds meet, one is most careful that the division takes place safely within the region supplied by the left colic artery so that a free blood-supply be present for the repair of the divided end. Therefore, in question of doubt, let the division of the bowel be rather nearer to, than further from, the spenic flexure. Between double clamps the transverse colon is divided — after which the proximal end is surrounded by gauze and additionally clamped, and the distal end is invaginated by a double tier of sutures. The mesocolon of the transverse colon is now divided up to the ligation of the middle colic vessels. The great omentum is divided with scissors, from its lower free edge, up to the junction of the middle and outer thirds of the transverse colon, at

the site of its distal section, and is then further divided to the right, parallel with the upper border of the colon, until the connection of the colon to the stomach is entirely severed. All bleeding vessels are ligated with fine chromic catgut. The free margins of the severed omentum are ligated in segments, by plain ligatures, or are controlled by interlocking ligatures.

Having thus excised the involved and immediately adjacent portions of the bowel, junction of the proximal and distal limbs of the intestinal tract, with restoration of the fecal circulation, must be established in one of the several ways mentioned above. The determination of the method of connecting up the bowel tract must be determined by the conditions encountered in the individual case, and by the predilection of the individual Surgeon _ statements as comprehensive as trite.

Lateral colocolostomy, after invagination of the divided ends, would seem the method of choice, where sufficient mobility is present to enable the span to be made. This technic is described on p. 69.

Ileosigmoidostomy is described on p. 67.

Further excision of the proximal portion of the ascending colon and cecum, with the performance of lateral isoperistaltic ileocolostomy, would be accomplished by the operation just described above, plus ileocecal excision, followed by lateral isoperiastaltic ileocolostomy, already described in Vol. IV, p. 812.

Comment.—The removal of the hepatic flexure is a relatively infrequent operation, but, owing to the more superficial situation of the hepatic flexure, as compared with the deeply seated splenic flexure, excision of the former is an easier operative procedure than the latter.

See Excision of the Colon, in General, p. 5.

EXCISION OF THE MORE CENTRAL PORTIONS OF THE TRANSVERSE COLON —FOLLOWED BY LATERAL COLOCOLOSTOMY

Description.—This portion of the large bowel is so much more accessible, and, owing to its more constant and longer mesentery, so much more movable, that excision of its parts is simple, as compared with the removal of some of the deeper, more bound-down parts of the colon. The usual repair of the tract, following partial excisions, is by lateral anastomosis after invaginating the divided ends (although axial colocolostomy is sometimes performed). The vessels of this part of the colon come from the middle and left colic arteries on the two sides.

Preparation _ Position _ Landmarks.—As for median or paramedian abdominal section.

Incision.—A vertical incision is made, with its center opposite the umbilicus _ and this incision may be either median, or right or left paramedian, according to circumstances (and through the rectus or, preferably, after retracting its inner border outward).

Operation.—The portion of the transverse colon here removed is such as shown in Fig. 4104. Upon opening the abdomen the margins of the wound are retracted, the condition of the intra-abdominal structures examined _ the transverse colon and great omentum are drawn out of the wound upon hot towels, and the rest of the peritoneal cavity packed off. Having determined upon the segment of transverse colon to be removed, the great omentum is divided at each limit of the loop of the colon to be excised, the section extending from its lower free border, up to the colon. It is well to first tie the omental vessels which will be divided by underrunning them, and then sever the omentum within the two parallel lines of ligatures. Sometimes they are first clamped through the omentum, and then tied when the omentum is cut. The mesocolon is also divided on each side of the intended excision of the bowel

– exercising, here, the greatest care to plan the division of the vascular loops of the mesentery so that the very ends of the divided colon will receive full blood-supply, the loops being supplied by the middle colic, on the right, and the left colic, on the left. The divided ends of the mesenteric vessels are ligated with fine catgut. When all is ready, the indicated portion of transverse colon is excised between a set of clamps at either end of the segment. All lymphatic structures of the region are removed (v. p. 65).

The usual method of restoring the colonic tract is to invaginate the ends of the colon by a double tier of sutures, and then do a lateral colocolostomy – and the site of anastomosis may be further reinforced by omental grafting. Owing to the mobility of the transverse colon union may be made end-to-end. The abdomen is closed without drainage.

Comment.—The lymphatic glands to be removed are chiefly found along the branches of the middle colic artery. The paracolic glands are removed with the colon.

The superior mesenteric artery is to be especially guarded, while incising the mesocolon.

The lateral enterostomy is made between the antimesenteric aspects of the colon, through a longitudinal muscular band.

EXCISION OF THE SPLENIC FLEXURE OF THE COLON, TOGETHER WITH THE ADJACENT PARTS OF THE TRANSVERSE AND DESCENDING COLONS, FOLLOWED BY COLOCOLOSTOMY

Description.—The splenic flexure lies at a much greater depth than does the hepatic flexure, and manipulations in its connection are more difficult. A mesocolon is found in 5 per cent. of cases. The left colic artery supplies the flexure – and when the part is excised the severed end of the transverse colon must receive its blood from the middle colic artery, and the divided end of the descending colon, from the sigmoid arteries. Usually the sigmoid flexure, the distal third of the transverse colon, and half, or even most of the descending colon, are removed – together with the lymphatic structures of these parts (v. p. 65). The lymphatic vessels chiefly pass to the epicolic and paracolic glands. Exceptionally some pass to the intermediate glands, but none pass directly to the main glands. The epicolic and paracolic glands and those along the left colic artery are removed. As some of the lymphatics may pass into the splenic glands, radical removal of lymphatics may sometimes be impossible in operating upon the splenic flexure. Following the excision of the structures the intestinal tract is reconnected by either a lateral or an axial colocolostomy.

Preparation – Position – Landmarks.—As for abdominal section by the incision chosen (v. i.).

Incision.—This will vary according to the Surgeon's judgment. The incision may be one of the following, – vertical, through the outer aspect of the left rectus – vertical, through the left linea semilunaris – or oblique, parallel with the left costal arch. The last gives, mechanically, the best approach to the deeply lying structures. The musculature is apt to be damaged in extensive operations.

Operation.—The abdomen is opened, the parts examined, and the outlying regions protected by packing, while the margins of the wound are retracted. The left colic artery and vein are exposed and each is separately tied to the outer aspect of the inferior mesenteric vein. The descending colon and the splenic flexure are drawn mediad – and the parietal peritoneum to the outer aspect of these structures is severed with scissors, from the lower level at which the descending colon is to be divided, upward parallel with the

bowel and through the phrenocolic ligament (Fig. 4105). When this section of the peritoneum has been completed the fingers, used hook-fashion, in the freed interval, now displace the colon and flexure toward the median line, together with the detached peritoneal margin and subperitoneal glandular connective tissue. To free the inner aspect of the colonic structures two incisions are made from the site of ligation of the left colic vessels – one, upward and outward, to end safely within the limit of supply of the middle colic artery to the transverse colon (the junction of the middle and left thirds)



Fig. 4105.—Excision of the Splenic Flexure of the Colon, Together with the Immediately Adjacent Parts of the Transverse and Descending Colons – to be Followed by Colocolostomy; – The peritoneum has been incised upward, with scissors, along the outer aspect of the descending colon, including the division of the phrenocolic ligament, toward the splenic flexure – after which the splenic portion of the descending colon is mobilized by being displaced inward – thereby exposing a raw area in which are seen the inferior pole of the left kidney, the psoas muscle, with the ureter and spermatic vessels passing downward over the latter structure – and the abdominal aorta, inferior mesenteric artery, and left common iliac lying more mediad.

– the other, downward and outward, to that level of the descending colon which is supplied by the highest one of the sigmoid arteries. The corresponding part of the great omentum is ligated and excised. Finally, the ends of the freed segment are divided between double clamps – after which the distal end of the transverse colon is axially anastomosed with the proximal end of the descending colon – or the ends are invaginated by a double tier of sutures, and then anastomosed, side to side. The abdomen is closed without drainage.

EXCISION OF THE DESCENDING COLON, INCLUDING THE SPLENIC FLEXURE AND UPPER PORTION OF THE SIGMOID, OR PELVIC COLON—FOLLOWED BY COLOCOLOSTOMY

Description.—The portions of the colon excised in this procedure are largely determined here, as elsewhere, in these operations, by the blood-supply of the part. The proximal division is made through the transverse colon, at the junction of its middle and left thirds – that is, at a site up to which the supply of the middle colic artery safely comes, after ligation of the left colic artery. The distal division is made through the upper part of the sigmoid flexure rather than through the descending colon – the first sigmoid artery being tied near its origin. The segment to be excised in shown in Fig. 4105.

The lymphatic groups of the involved region are the epicolic, paracolic, and intermediate (upon branches of the left colic and first sigmoid arteries) – as well as some communicating lymphatics which empty into the splenic glands, and whose removal is impracticable.

Tumors of the descending colon are comparatively rare. A mesocolon is present more frequently than in the case of the ascending colon – but the descending colon is deep, and this fact, and its fixation, make operations upon it difficult.

Preparation – Position – Incision.—As for abdominal section by vertical incision through the outer portion of the left rectus, or through the left semilunar line.

Operation.—Upon exposure and examination of the field, the left colic artery and vein are ligated externally to the inferior mesenteric vein and anteriorly to the kidney hilum. The parietal peritoneum is then incised along the outer side of the splenic flexure and the descending colon, after which these parts of the large bowel are freed by blunt dissection in the subperitoneal connective-tissue plane, and, together with vessels and lymphatics, displaced inward.

A triangular block of tissues is then excised, the apex of the triangle being at the ligated left colic vessels, and the base represented by the freed colon. An upward line of section is carried from the point of ligation to the transverse colon, at the junction of its middle and left thirds – and a downward line of section, to the upper part of the sigmoid colon. At the extremities of these peritoneal incisions the transverse colon and the sigmoid colon are divided between two sets of clamps – and the excised segment and attached tissues removed. The colonic tract is reconstructed by axial or by lateral anastomosis.

EXCISION OF THE LOWER PORTION OF THE SIGMOID, OR PELVIC COLON—FOLLOWED BY COLORECTOSTOMY, OR BY LEFT INGUINAL COLOSTOMY, OR BY ADDED PARTIAL RECTECTOMY AND RECTORECTOSTOMY

Description.—The portion of the colon here included in the excision would have its upper limit at the middle of the sigmoid loop (which begins at the left iliac crest), and its lower limit would pass through the sigmoid loop just above the commencement of the rectum – the sigmoid loop ending and the rectum beginning upon the third sacral vertebra. The excision involves the ligation of the inferior mesenteric artery and vein. The remaining upper portion of the sigmoid colon will receive its blood-supply from the left colic artery – and the rectum will receive its from the middle hemorrhoidal branch of the internal iliac artery, and from the inferior hemorrhoidal branch of the internal pudic artery. The lymphatics involved are more extensive than often encountered in other parts of the colon, and include all four groups, the epi-

colic, paracolic, intermediate (upon the sigmoid arteries), and main (upon the inferior mesenteric artery) (v. p. 65).

Operation.—The patient is placed in a high Trendelenburg position, and the abdomen is entered either by a left paramedian incision, or by an incision in the left semilunar line. After exposing, examining, and packing off the abdominal contents, and retracting the margins of the wound, the pelvic colon is displaced laterad – and the parietal peritoneum incised through the median leaf of the sigmoidal mesocolon (Fig. 4106). The peritoneum and sigmoid

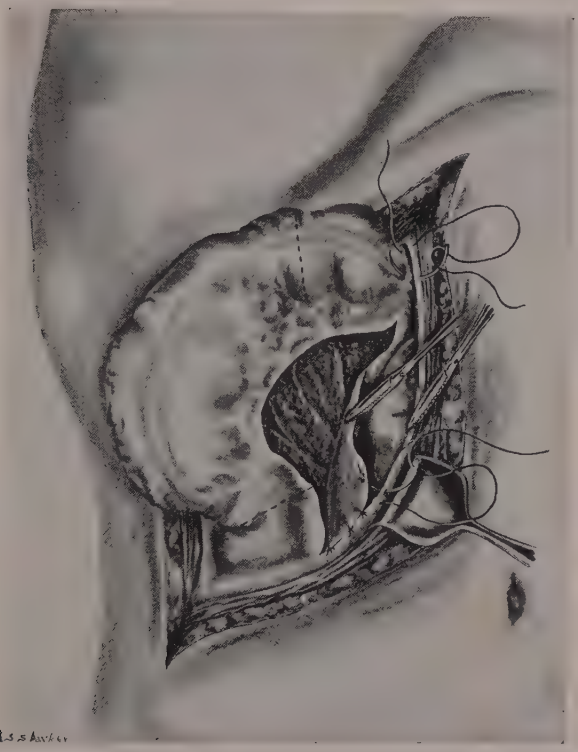


Fig. 4106.—Excision of the Pelvic, or Sigmoid Loop of the Colon, for Carcinoma – Followed by Colorectostomy – I; – The patient is in the Trendelenburg position. The median leaf of the sigmoid mesentery is incised, following the curvature of the sigmoid, and the colon displaced to the outer side. The incised median leaf of the mesocolon is being sutured to the parietal peritoneum of the median margin of the abdominal wound – thus forming the median boundary of the cofferdam-like technic. Each of these margins of peritoneum are grasped by forceps to aid in the suturing – the small intestines being held back in the general peritoneal cavity, which is being thus walled off. The proximal and distal aspects of the exposed colon are seen – and the lines along which it is to be doubly divided are dotted. The mesenteric vessels which supply the segment to be excised are ligated – carefully preserving those to the adjacent portions of the colon.

are then freed by blunt dissection and displaced mediad – being especially careful of the left ureter and the spermatic vessels in the inward progress of the dissection, and remembering that the ureter is apt to cling to the peritoneum as it is raised. The inferior mesenteric artery and vein are exposed and are ligated between double ligatures – below the origin of the left colic vessels. The site of this ligation will determine the triangular aspect of the excision – its apex being at the ligation – its upper limb passing outward through the middle of the pelvic colon (maintaining as ample a blood-supply

from the sigmoid artery as possible) – and its lower limb, outward and downward through the lowermost part of the pelvic colon, along the inner aspect of the sigmoid mesocolon, just proximal to the beginning of the rectum. When the tissues represented by this triangle have been freed, the upper and lower limits of the pelvic colon are compressed by two sets of clamps, applied along the dotted lines (Fig. 4107) and divided.

The reconstruction of the bowel tract will depend upon circumstances. It is the remaining lower segment of the bowel (the rectum) which is most endangered by ligation of the inferior mesenteric vessels. The severed end of

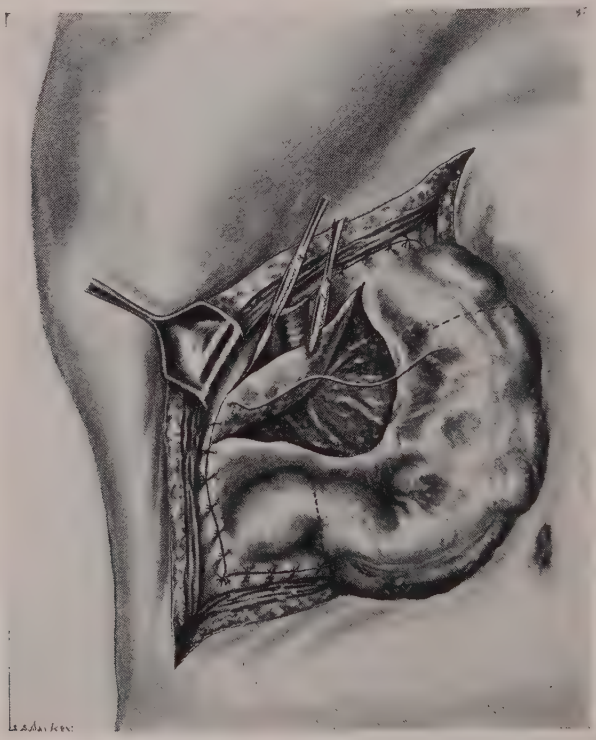


Fig. 4107.—The Same – II; – The sigmoid loop, first mobilized upon its median aspect, is now displaced toward the opposite side, exposing the lateral leaf of the sigmoid mesocolon – which, in turn, is similarly incised, freed, and sutured to the margin of the parietal peritoneum of the lateral lip of the abdominal wound – thus entirely exteriorizing the sigmoid flexure. Whatever mesenteric vessels may have escaped ligature upon the median aspect, of those directly supplying the area to be sacrificed, are ligated. On both median and lateral aspects of the wound the margins of the ends of the freed peritoneum are sutured around the limbs of the colon – to the outlying aspects of the area to be excised.

the pelvic colon has the left colic artery – but the rectum will only have the middle and inferior hemorrhoidal vessels – and, in some types of vascular degeneracy, this may not suffice. It may be concluded that the circulation through the rectum is sufficient, if the free edges of the rectum bleed with normal vigor, on temporarily relaxing the clamp which compresses them – and insufficient, or doubtful, if they do not. Consequently, one of several courses is open: –

If the blood-supply of the bowel ends be sufficient, a colorectostomy may be performed – which may be either terminal (end to end – Fig. 4108) – or

lateral (side to side, after invaginating the ends). Either of which is difficult to carry out in this locality — and the choice must be based upon the circumstances of the individual case.

If the blood-supply of the bowel ends be insufficient, or doubtful, one of two courses may be followed: — (*a*) The free end of the lower segment may be invaginated and left *in situ* — and the free end of the upper segment be brought out upon the skin surface, as a left inguinal colostomy (which is probably the safest course); — or (*b*) The free end of the lower segment is further freed, down to the pelvic peritoneal reflection, after which it is drawn down out through the (everted) anus by forceps introduced upward from below. The free end of the upper segment (after mobilization) is then drawn down, by forceps similarly introduced, until it protrudes through the anus — after which a portion of it is excised down to a level of satisfactory vasculari-

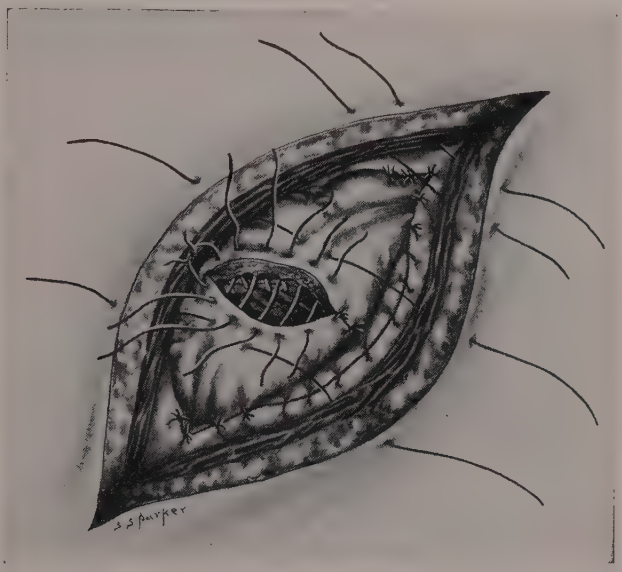


Fig. 4108.—The Same — III; — The ends of the colon are being sutured together. The general peritoneal cavity is seen to be entirely shut off from the field of operation by suturing the margins of the parietal peritoneum to each other or to visceral peritoneum — seen in the Trendelenburg position.

zation. The two concentric margins of bowel are then sutured together — and are partly returned and partly drawn back into position.

EXCISION OF PART OF THE COLON BY THE TWO-STAGE OPERATION OF PAUL

Description.—The first stage of the operation consists in excising the segment of the bowel occupied by the growth, and temporarily anchoring the two ends of the colon in the abdominal wound — and the second stage, in reconstructing the continuity of the intestinal canal later.

Operation.—If the site of involvement be previously recognized and directly cut down upon, the same wound is used for the anchorage. If the involvement be one lying to one side, but discovered through a median abdominal section, a secondary abdominal incision is made directly over the growth, for the further exposure and anchorage — and the median wound is closed. The segment of intestine is freed of adhesions and brought into the

wound. The mesentery of the barrel of bowel to be excised is ligated and divided between ligature and bowel — which additional freeing of the intestine will enable it to be further drawn out of the wound. The two limbs of the segment, drawn parallel and lying in contact, are united by catgut sutures along the raw surfaces from which the mesentery has been cut after ligating it. The two limbs are then sutured into the margins of the abdominal wound with chromic catgut, at their exit from it, and the excess of the abdominal wound is closed in from either end with silkworm filament. Having protected the wound from possible soiling, if the opening is to be made immediately the diseased portion of the protruding loop of colon is excised, and a Paul glass tube, with long rubber tube attachment, tied into it — thus conducting the outflow to a distance.

The second stage, performed at a later date, is accomplished by breaking down the double, contiguous intestinal wall by means of an enterotome (v. pp. 43–46) — detaching the adherent colon from the abdominal wall, immediately around the colostomy opening, and suturing the margins of the intestinal opening together — and at once closing the opening in the abdominal parietes by suture.

It would seem as though the safety of the technic might be enhanced by adding a third stage to the procedure, — namely, after suturing the intestinal opening, at the end of the second operation, to leave the sutured bowel *in situ*, in the open wound, for three or four days, to see that its union is satisfactory — and then, finally, close the opening in the abdominal wall.

PARTIAL EXCISION OF THE COLON BY THE FOUR-STAGE METHOD OF MIKULICZ

Description.—This has usually been described as a two-stage operation — but, evidently, incorrectly, as will be seen from the detailed account of the operation. Its characteristic feature is that the anchored loop of bowel is not excised for several days — whereas, in the Paul operation, the excision is performed at once. The method of Mikulicz is applicable to any part of the large bowel which can be sufficiently drawn through, and anchored in, the abdominal wound, and is one of the safest methods used.

Operation.—While a number of minor variations in technic are in vogue in the details of this procedure, the essential aims and steps are the same. The following technic is employed in its essential features by the Mayos.

First Stage: If there be any guide to the site of intestinal involvement, the abdomen is opened over this site. If the condition be located only after the abdomen has been opened, a secondary opening is usually made directly over the site, and the median abdominal wound closed. The segment of bowel in which the tumor lies is mobilized, and adhesions broken up, and the bowel and mesentery brought into the wound. A V-shaped section of the mesentery is made. This mesenteric section is planned, first, to preserve the necessary blood-supply of the part by not dividing vessels which supply those parts of the two limbs of the colon which will be permanently retained (Fig. 4109) — and, second, so as to include in that portion of the mesentery which is to be brought out of the wound, and eventually excised, the area of immediate lymphatic drainage. The peritoneal surfaces of the adjacent limbs of the colonic loop are sutured together for some distance with fine catgut (Fig. 4110). This suturing may be upon one, or upon both aspects of the joined limbs. The colonic limbs are cleared of mesenteric tissue and sutured together for several centimeters (inches) — intestinal loop, with tumor and partly detached mesentery, all being delivered outside of the abdomen for some distance. The parietal peritoneum and margins of the abdominal wound are

sutured closely around the base of the two protruding intestinal limbs – but not tightly enough to strangulate them – and the wound is left to heal, with the intestinal loop entirely extraperitoneal. The parts are covered with rubber tissue and dressed.

Second Stage: After three to seven days the protruding colonic loop is excised, at a safe distance beyond the skin level – leaving the two colonic limbs as a double-barrel tube, with open, free ends.

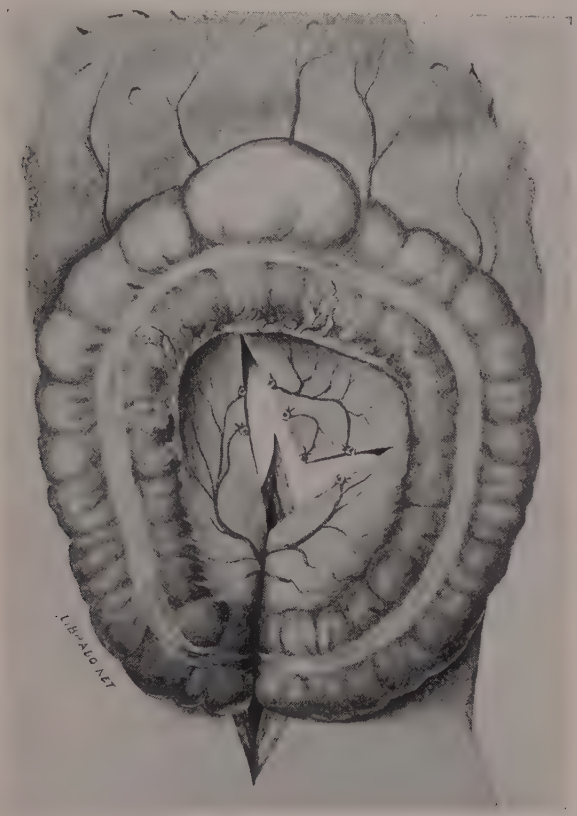


Fig. 4109.—Partial Excision of the Colon by the Four-stage Method of Mikulicz – I; – The involved colonic loop has been delivered outside of the abdominal wound, and a V-shaped area of the mesentery doubly ligated and divided, carefully preserving the vessels which supply the portions of the two limbs of bowel which will be permanently preserved. This V-cut should include the part of intestine to be removed equidistantly on each side of the lesion.

Third Stage: In about ten or twelve days subsequent to the primary operation (five to seven days from the second stage) a 10 cm. (4 inches) entertome is, at first, lightly closed upon the intestinal spur formed by the double walls of the colon – one limb of the instrument passing into each limb of the colon (Fig. 4111). The blades of the enterotome are additionally tightened each following day – until, in about six days, it has cut its way through the double-walled spur, making into one the canal of the two limbs, down to the limit of the clamp.

Fourth Stage: A few days after the enterotome has cut away the intervening wall between the two colonic limbs the intestinal opening is closed

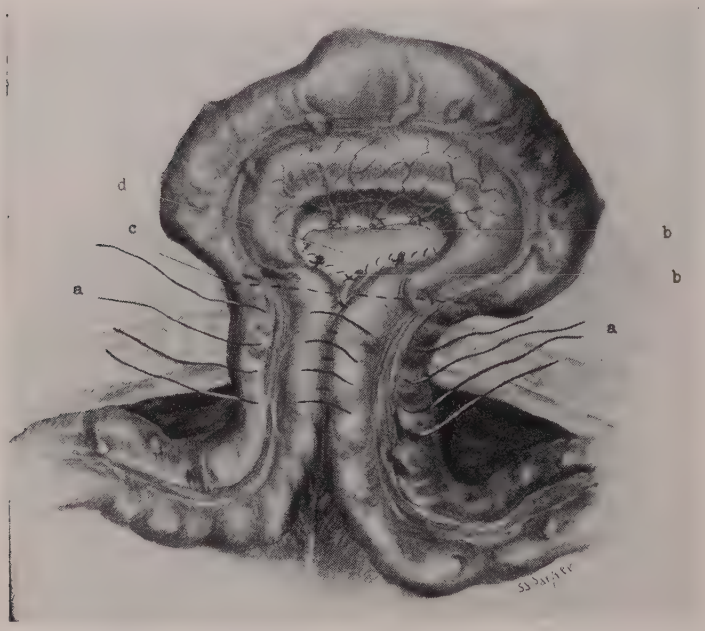


Fig. 4110.—The Same – II: – a, a, Non-penetrating sutures uniting the serosæ of the limbs of the colon (corresponding sutures have been placed and tied on the opposite side); – b, b, double ligation of three mesosigmoid arteries. (Sutures anchoring the intestinal loop into the wound are not here shown.)



Fig. 4111.—The Same – III; – Crushing the spur of the colonic loop with heavy enterotribe (too light and too short-bladed an instrument being here shown).

by an extraperitoneal plastic operation. The immediate margins of the colonic opening are mobilized and freshened (being careful not to continue the

mobilization beyond the limits of the surrounding adhesions) – after which they are brought together and sutured – and over this the structures of the abdominal wall are sutured. (As mentioned under Paul's operation, p. 75, it would seem safer to suture the freshened intestinal margins together – wait two or three days to see if union were satisfactory, and then close the abdominal wall – which, however, would really make five stages of the operation.)

Comments.—While the Mikulicz operation is especially applicable where the segment of the bowel can be readily delivered out of the abdomen, the Mayos have successfully applied the method even to the upper part of the rectum – bringing this portion of the large intestine up into the abdominal wound.

Where emergency is present, and delay cannot be exercised in opening the bowel, as may occur in some cases of obstruction, the Mayos depart from the above routine, and apply the technic of the Paul operation, immediately



Fig. 4112.—Destroying the Colonic Spur; – Increasing the lumen of the colon by still further lowering the spur by means of Wales' rubber bougie introduced from the anus.

after anchoring the loop of colon, or, if possible, after some adhesions have formed, tying in the glass drains, with rubber tube attachment.

The method of Hochenegg may also be employed where immediate opening is necessary – which is accomplished by tying in a single tube through one opening in the convexity of the loop or in the proximal limb of the loop.

In those cases in which the circulation of the part is doubtful, Peck cuts the loop and tumor away at once – after ligating and sterilizing the ends of the colon.

The especial field of application of the Mikulicz is from the hepatic flexure to the distal end of the sigmoid colon – and it is within this stretch of colonic tract, according to Bergmann, that nearly 70 per cent. of the malignancies occur, which are situated above the rectum. In the ileocecal region the conditions, especially the fluidity of the bowel contents, favor the one-stage operation.

C. H. Mayo, who introduced the Mikulicz-Bruns method of colectomy (under which designation the above technic is also known), states that this method of resecting the second half of the colon has probably accomplished

more to extend the operability and reduce the mortality in operating in this region than any other factor.

If the operation has been applied to an excision in the region of the sigmoid colon, where the technic has been especially worked out by Tuttle, the

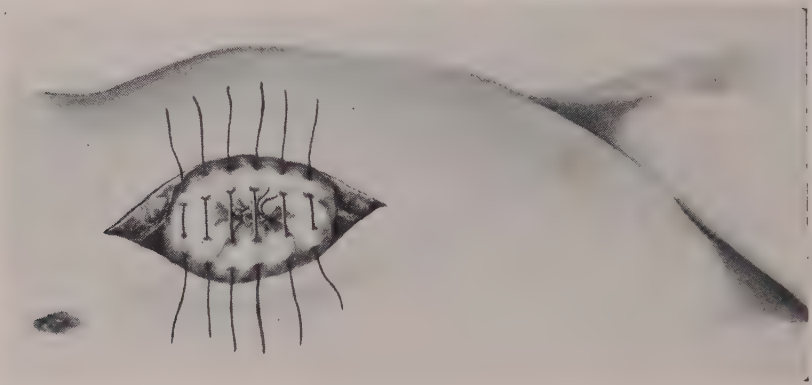


Fig. 4113.—Closing the Colostomy Opening; – Following the freeing of the colonic loop from the wound margins, its opening is first invaginated by suture, and then reinforced by Lembert sutures – preparatory to closing the abdominal wound.

resulting spur, after destroying the main portion of the two adjacent walls by means of an enterotome, may be further lowered by the daily passage of a Wales rubber bougie from the anus (Fig. 4112). At the time of closing



Fig. 4114.—The Same – IV; – Closure of the abdominal wound by ordinary **a**, and relation, **b**, sutures Course of the lowered colon loop seen in dotted cross-section

the colostomy opening his method of mobilizing the margins of the intestine and invaginating the site by a double tier of intestinal sutures, the second tier, non-penetrating, is shown in Fig. 4113. The final closure of the abdominal wound, by marginal and relaxation sutures, is seen in Fig. 4114.

PARTIAL EXCISION OF THE COLON BY THE THREE-STAGE METHOD OF SCHLOFFER

Description.—The three stages of this method are — the formation of an artificial anus, proximal to the lesion — the excision of the segment of intestine involved by growth, and its repair — and the closure of the artificial anus. The special field of application of this procedure is in acute or chronic obstruction, due to tumor — although it is one of the best and safest methods of operation, independently of obstruction.

Operation.—The steps of the operation are as follows: —

First Stage: The selection of the site for the artificial anus is usually as far away to the proximal side of the involvement as possible — and this, as a rule, the cecum. A cecostomy is performed in the usual manner (Vol. IV).

Second Stage: Two or three weeks later the segment of the bowel bearing the tumor — in this case, supposed to be in the sigmoid colon — is excised — and the intestinal tract immediately reconstructed by end-to-end or by lateral entero-anastomosis.

Third Stage: The artificial anus (cecostomy wound) is closed as soon as the success of the excision of the growth and the colocolostomy is assured. The closure of the cecal anus is accomplished as in the closure of a colostomy wound.

Comments.—If this technic were applied to the cecum the artificial anus would have to be made in the ileum — but in the case of the cecum the primary operation of excision with immediate entero-anastomosis is usually the operation of choice. In all other parts of the large intestine the method of Schloffer is applicable.

PARTIAL EXCISION OF THE COLON BY THE TWO-STAGE METHOD OF HOCHENEGG AND LANGEMAK

Description.—The site of colonic involvement is first short-circuited — and later excised. The chief field of application of this method is in cases of tumor of the cecum, especially when associated with inflammatory and suppurative complications.

Operation.—The steps of the operation are the following: —

First Stage: If the involved region be the cecum, this is first short-circuited — which is accomplished by dividing the ileum at about 15.2 cm. (6 inches) from the cecum, invaginating both ends of the ileum, and then anastomosing the proximal end of the ileum with the transverse colon by lateral ileocolostomy.

Second Stage: At a later period the remnant of the ileum and part or all of the ascending colon, including the tumor, are excised, and the distal end of the transverse colon closed.

PRIMARY PARTIAL EXCISION OF THE COLON, FOLLOWED BY COLOCOLOSTOMY—WITH TEMPORARY ARTIFICIAL ANUS PROXIMAL TO THE ENTERO-ANASTOMOSIS

Description.—After having performed an ordinary primary excision of a segment of the colon, an artificial anus is established to the proximal side of the entero-anastomosis — the object being to make provision for the temporary outward escape of the intestinal fluids or contents — both for the purpose of keeping them from passing over the site of anastomosis during healing, and also to prevent gaseous or fecal distention of the site of suturing while the parts are uniting.

This procedure is illustrated where a segment of the sigmoid has been excised, and the resulting ends united — after which a left inguinal colostomy has been performed to protect the lower operation.

PRIMARY PARTIAL EXCISION OF THE COLON WITHOUT COLOCOLOSTOMY —FOLLOWED BY PERMANENT ARTIFICIAL ANUS

Description.—This procedure is sometimes resorted to in operating under circumstances or in positions of difficulty – as deep in the pelvis and in the presence of unusual complications. The segment of colon is excised – the distal end closed and left in the cavity – and the proximal end brought out upon the skin. The problem is more apt to be encountered in connection with rectal surgery.

Such a procedure, however, is to be very much regretted, and every reasonable means used to avoid it – such as even drawing down the transverse colon until it can be anastomosed with the remaining distal segment of the rectum – or by the interposition of a segment of small intestine between the free ends of the colon and rectum.

EXAMINATION OF THE ANORECTAL TRACT

For the purpose of recording data in connection with pathologic findings, and operative technic about the anorectal region, the external aspect of the

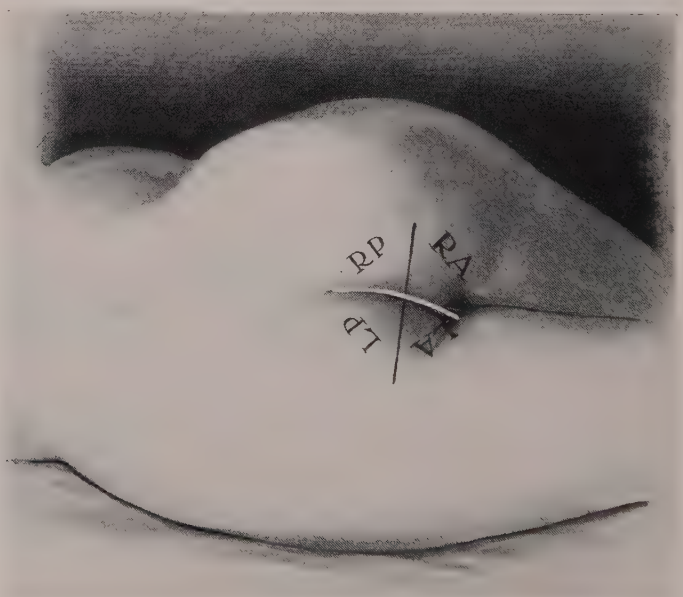


Fig. 4115.—Quadrants of the Anorectal Region; – The axial line runs from the tip of the coccyx to the symphysis pubis; – the transverse, from the prominence of one ischial tuberosity to that of the other – thus dividing the anorectal region into right anterior, left anterior, right posterior, and left posterior quadrants, for the more accurate location of lesions.

fundament has been conveniently mapped off into four quadrants – as shown in Fig. 4115.

Several positions are in use in making examinations of the anorectal outlet and tract, of which the following are those most frequently employed – both in examinations and in operating.

Sims' Left Lateral Position – Fig. 4116 – where, in addition to the position, the upper right natis of the patient is lifted and held out of the way by the hand of an Assistant, or often, by the patient's right hand. This po-

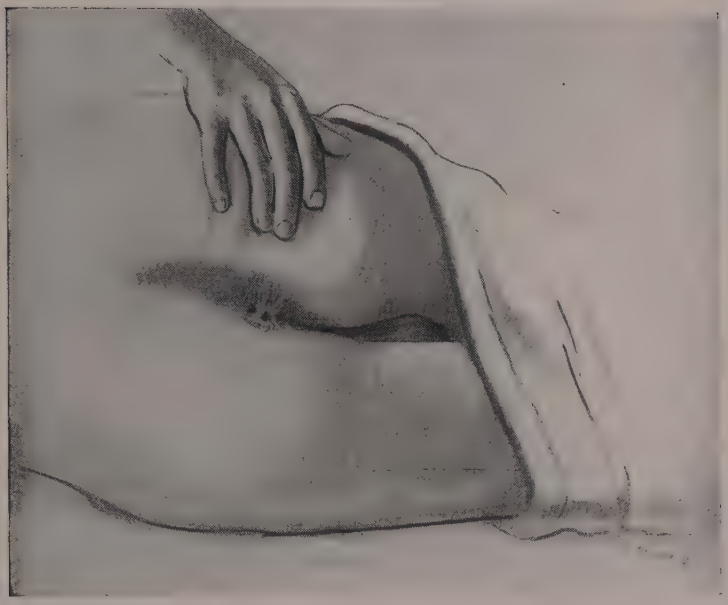


Fig. 4116.—Sims' Position as Used in Anorectal Work – with the upper natis elevated by the corresponding hand of the patient – or by an Assistant's hand.

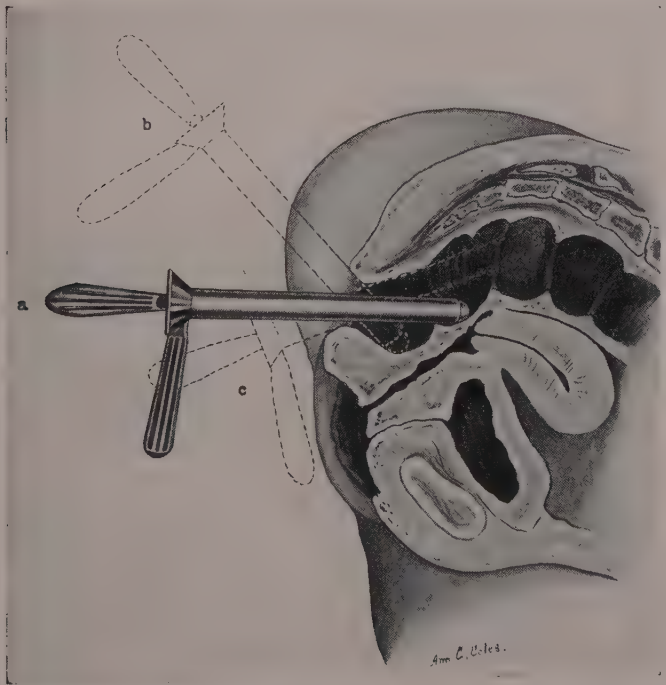


Fig. 4117.—Technic of Proctoscopic Examination: – a, Method of introduction of the proctoscope, with the patient in the genupectoral position; – b, examination of the anterior rectal wall; – c, examination of the posterior rectal wall.

sition is considered, by many, as the most generally useful anorectal posture. The patient lies upon his left side, with chest upon the table, the thighs markedly flexed, the right knee being higher than the left, and the left arm behind the back ; and, preferably, with the buttocks somewhat elevated by a hard cushion or sand-bag.

Exaggerated Lithotomy Position — as assumed in the operations for hemorrhoids, is the position probably most frequently assumed in operations about this region. The patient should lie somewhat over the end of the table. For examination, the buttocks should be elevated somewhat — while for operation the same position is used or, generally, the full horizontal decubitus.

Knee-chest Posture — shown in Fig. 4117 (sectionally) — and also in illustrations among the operations upon the vagina, and upon the female urethra and bladder. If this position must be maintained for any length of time, the patient is usually partly, or entirely supported by the straps from the two metallic uprights at the end of the table. It is the most usual position

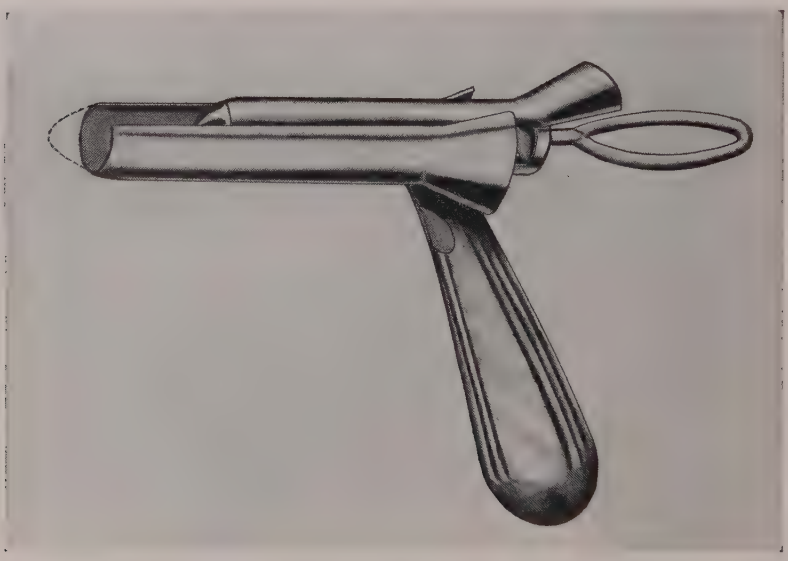


Fig. 4118.—Murray's Rectal Speculum.

employed in the use of the longer cylindric specula. It is to be noted that the position is not the knee-elbow, but literally the knee-chest posture — in which the back sags down at a marked angle with the thighs.

In any of these positions any specula may be employed — although the knee-chest position is more appropriate for examination with the longer types of cylindric specula — and the left lateral, or exaggerated lithotomy, for the shorter cylindric specula (Fig. 4118), or for the dilating specula (Fig. 4119).

Sometimes the additional light from a head-mirror (Fig. 4120) is helpful.

Digital examination should also be a part of every general examination of the anorectum — which can be carried out in any of the above-mentioned positions.

Univalve specula are often employed (Fig. 4121).

Illuminating specula are also employed (Fig. 4122).

The extreme limit of examination by sight and touch are secured in the condition of relaxation resulting from the stretching of the anorectal outlet,

as practised prior to operating upon hemorrhoids _ and which is described on p. 132 _ and illustrated in Fig. 4187.



Fig. 4119.—Allingham's Quadrivalve Rectal Speculum.

Bidigital examination is possible in female patients _ and sometimes useful. Either the right forefinger is introduced into the rectum, and the right thumb into the vagina _ or the index-finger of one hand is introduced into the rectum, and that of the other into the vagina. In the case of the male, a

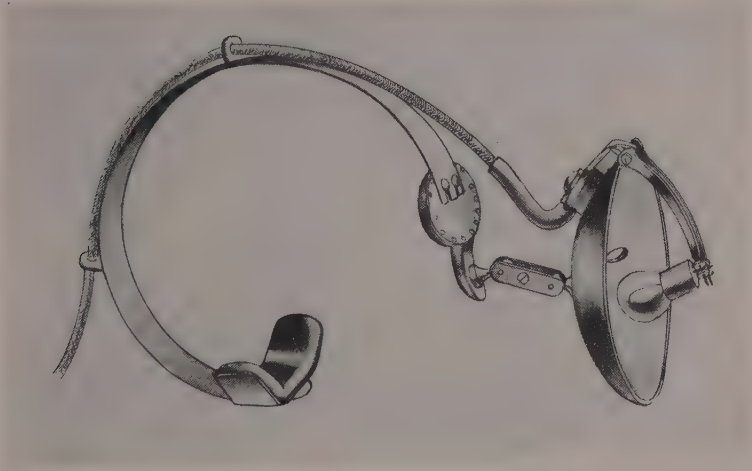


Fig. 4120.—Mirror Reflecting Electric Headlight.

modified form of bidigital examination is possible _ with one forefinger within the rectum _ and the opposite forefinger exercising counterpressure against it, through the perineal wall.

Various forms of self-illuminating sigmoidoscopes are in use _ the most

serviceable types being so constructed that the rectal mucosa at the distal end of the instrument can be pneumatically ballooned out – thus unfolding or unrolling it before the examining eye.



Fig. 4121.—Hirschmann's Rectal Retractor.

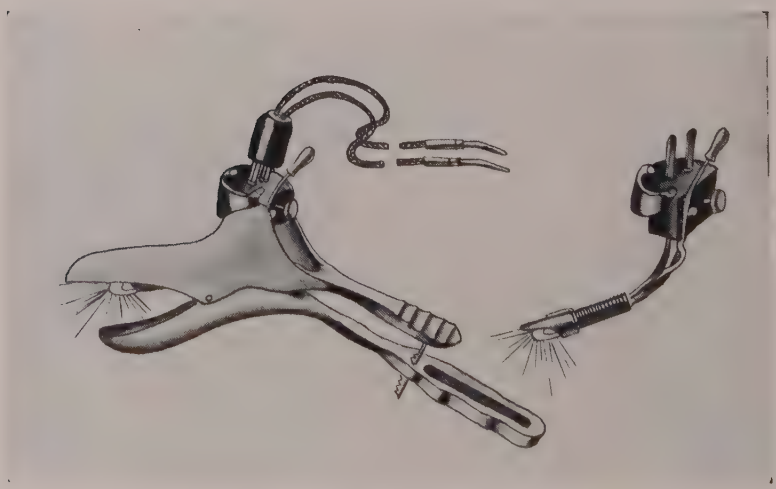


Fig. 4122.—Electric Rectal Bivalve Speculum.

In introducing the long sigmoidoscope the knee-chest position is best for both sexes when examined unanesthetized – and the left lateral posture when examined under anesthesia. The warmed and lubricated tube is in-

troduced while the patient simultaneously strains down and relaxes. The instrument is either first introduced to the highest point to be examined and then the obturator withdrawn and the examination conducted as the instrument is withdrawn (which is always necessary if the rectal mucosa be not pneumatically ballooned out ahead of the advancing instrument), or, in the case of the pneumatic sigmoidoscope, the obturator is withdrawn as soon as the distal end of the tube reaches the rectal ampulla (which begins as soon as the anal canal is passed), and the light is turned on for the pneumatic pressure, caused by compressing the hand bulb, results in the straightening out of the rectum and its elevation above the brim of the pelvis, thus aiding in the introduction of the straight instrument. Under direct eye observation the tube is carried upward and backward, first aiming at the sacral concavity when the proximal end of the instrument is now raised (if the patient be in the knee-chest position, or lowered, if in the dorsal posture), to allow the distal end of the tube to pass over the brim of the pelvis from which point onward the progress is usually easy. The chief obstructions which one expects to encounter are the lowest Houstonian valve and, opposite the second sacral vertebra, where the rectum may seem to end in a blind pouch. These difficulties are usually readily overcome by shifts in the position of the end of the tube and by partial withdrawals of the tube, followed by onward progress at a slightly different angle.

CONGENITAL ANORECTAL DEFORMITIES

Classification of Congenital Deformities, Among Which Some of the Deformities of the Anus and Rectum Occur.—The congenital deformities of the outlet of the intestinal tract are very numerous, and many of them are very complicated.

The following tabulation of these deformities is a modification of the Classification of Sir Charles Ball:

(*a*) **Arrest, or Irregular Development of the Hindgut** resulting in,
- Absence of whole large bowel, including rectum, with fecal outlet at umbilicus.

(*b*) **Arrest, or Irregular Development of the Post Allantoic Gut** resulting in,
- Imperforation of rectum.
- Imperforation of posterior urethral outlet.
- Imperforation of vesical outlet.
- Imperforation of vaginal or uterine outlet.
- Imperforation of spinal outlet.

(*c*) **Arrest, or Irregular Development of the Proctodeum** resulting in,
- Imperforation of anal canal.
- Imperforation of vulvar outlet.
- Imperforation of anterior urethral outlet.
- Imperforation of perineal, scrotal, or suburethral outlet.
- Anus well formed, but terminating in culdesac.
- Irregular development of anal canal other than occlusion.
- Urogenital outlet in rectum.

(*d*) **Persistence of the Postanal Gut** resulting in,
- Remnant of postanal gut as a diverticulum.
- Remnant of postanal gut as a congenital tumor.

Some of the more commonly occurring anorectal deformities will be briefly described and pictured and their general operative treatment alluded to,

but not gone into in detail. The conditions are often very complex — and the best technical method of handling these complications is frequently suggested only after actual exposure in the field of operation. Under separate headings, following, will be considered, in detail, operations for the membranous occlusion of the anus — for the absence of the anus, with the nearby presence of the rectum — and for a rectum arrested high up in the pelvis.

Where there is a total absence of bowel outlet, operation must, of necessity, take place within two or three days. Where a partial outlet exists, or an abnormal outlet, one may often temporize — according to the nature of the particular case.

Absence of the Entire Large Bowel with the Intestinal Outlet at the Umbilicus.—These cases are usually associated with other deformities — and, even independently, are generally beyond surgical succor.

Complete Absence of the Anus with a Nearby Rectum (Fig. 4123).—In those cases in which there is simply no anus, the rectum is, as a rule,

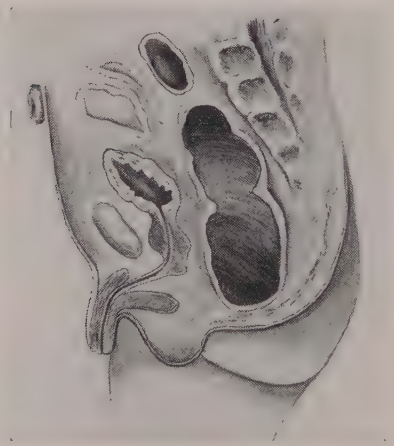


Fig. 4123.—Complete Absence of Anus.

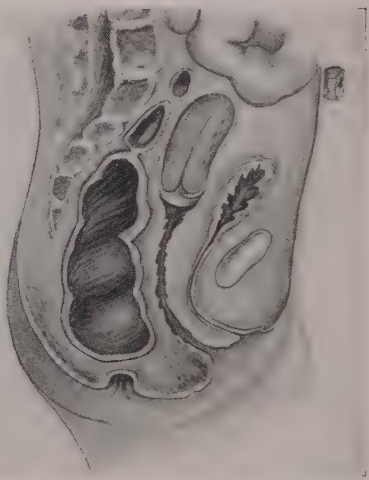


Fig 4124.—Failure of the Rectum to Connect with the Anus — the anus normal — imperforate anus.

nearby, and the surgical problem is a simple one — as will be separately described under imperforate anus, p. 97. It is, however, quite another matter when there is no anus, *because* the rectum has failed to descend (as will be illustrated below) — in which case the surgical problem may be very considerable.

Failure of the Nearby Rectum to Connect with the Anus (Fig. 4124).—Here the anus is present, and the case may appear to be normal until feces fail to appear. The rectum, however, is nearby, and in axis, is readily reached, operatively, through the comparatively thin partition — the operative technic being described under Imperforate Anus, p. 97.

Narrowed Lower Rectum and Anus (Fig. 4125).—Both rectum and anus are in normal position, and patulous, but their caliber is below normal. Constantly repeated dilatation of rubber bougies, of increasing size, may suffice to sufficiently increase the capacity of the anorectal canal. Failing in this, union between the two pouches, by dissection, in reasonable lengths of gap, is indicated, but difficult of accomplishment.

Anorectal Tract Occupied by Fibrous, Cord-like Structure from the Anus to the Blind Rectal Pouch (Fig. 4126).—In these cases it is not definitely known whether communication originally existed between rectum



Fig. 4125.—Narrowed Lower Rectum and Anus.



Fig. 4126.—Anorectal Tract Occupied by Fibrous, Cord-like Structure from the Anus to the Blind Rectal Pouch.

and anus, and then became obliterated, or whether the fibrous cord is of developmental origin – the latter seeming more probable. Operation for cases of failure of the rectum to descend will be considered separately (p. 98).



Fig. 4127.—Descent of the Rectum Posteriorly to the Anal Canal.

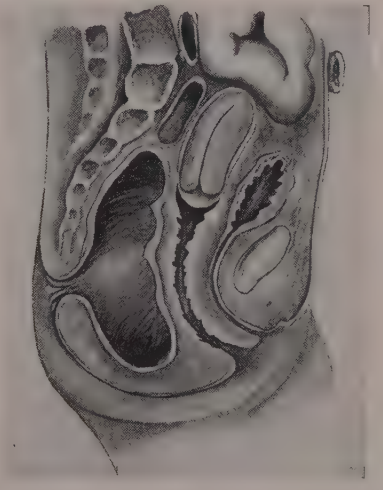


Fig. 4128.—Anus Opening Just Anteriorly to the Coccyx.

Descent of the Rectum Posteriorly to the Anal Canal with No Communication Between Them (Fig. 4127).—The wall which intervenes between the two parts of the anorectal canal will vary in thickness. In oper-

ating, it is sought to bring about communication between the two pouches — just as when they are separated by tissue, but lie in the same axis (as in Fig. 4126) — which will be described on p. 94.

Anus Opening Just Anteriorly to the Coccyx (Fig. 4128).—If the opening be provided with a sphincter, no operation is, ordinarily, indicated. If the sphincteric apparatus be absent, and the abnormal opening is not too far distant from the normal site of the anus, the abnormal anus, together with the rectal pouch, should be dissected away from their unnatural position, and be anchored to the skin in their usually occupied locality.

Extension of the Peritoneum Between the Blind End of the Rectum and the Blocked Anus (Fig. 4129).—Cripps has shown that, in conjunction with abnormality of the anus and rectum, there is apt to be some abnormality of the peritoneal pouch — which may pass backward, between the two non-connected structures, nearly to the coccyx — which would necessitate the infection of the peritoneal cavity if an exploratory needle were passed at random, or an incision similarly made, prior to recognition.

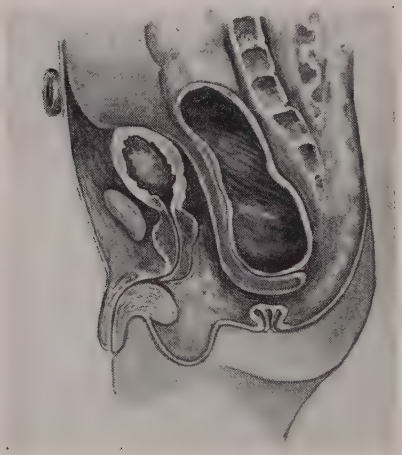


Fig. 4129.—Extension of the Peritoneum Between the Blind End of the Rectum and the Blocked Anus.

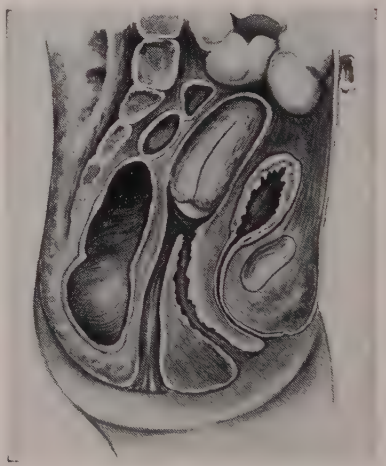


Fig. 4130.—Descent of the Rectum Posteriorly to the Anus — the anus opening into the vagina.

Descent of the Rectum Posteriorly to the Anus — the Anus Opening into the Vagina (Fig. 4130).—The indication here is to restore the continuity of the uterovaginal tract by union, by plastic procedure, between the posterior wall of the island of tissue intervening between the vagina and rectum, with the anterior wall of tissue anterior to the rectum — and then to bring the lower end of the rectal pouch into relation with the normal anus.

Cloaca, or the Opening of the Urethra, Vagina, and Rectum into a Common Outlet (Fig. 4131).—The operative correction of this complicated condition is described and pictured under the gynecologic operations (v. Vol. VI, Index).

Complete Absence of Rectum — the Colon Ending in a Large Dilatation and the Anus Being Normal (Fig. 4132).—In these cases it is sought to bring down the colonic pouch to the perineum, and anchor it in communication with the already present anus, the sphincters of which are usually present — (but generally absent from the site in those cases in which the anus is absent). Failing in this, it may only be possible to perform a colostomy.

Entire Absence of the Large Intestine – the Small Intestine Opening in Some Abnormal Position.—The position in which the small intestine may open is sometimes most unusual – cases having been encountered in

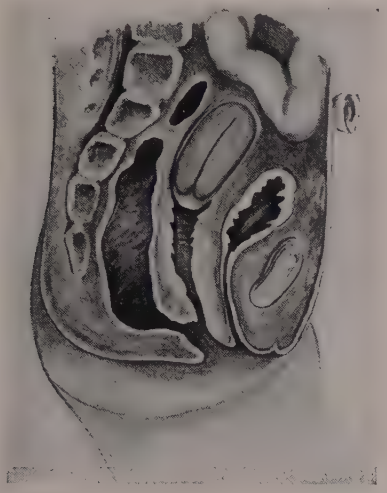


Fig. 4131.—Cloaca – the opening of the urethra, vagina, and rectum into a common outlet.

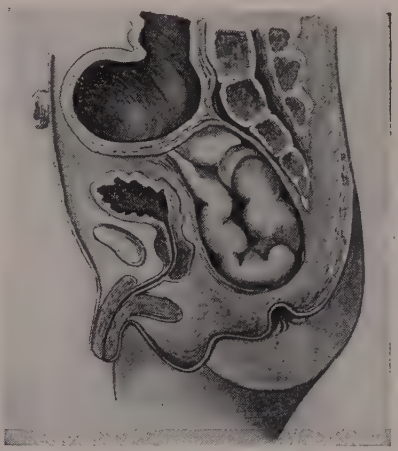


Fig. 4132.—Complete Absence of Rectum – the colon ending in a large dilatation – the anus normal.

which it has opened upon the thigh, in the neck, in the stomach, in the esophagus, and even on the shoulder. If the child survive the associated conditions, some extensive surgical procedure will be indicated – for the elimination of

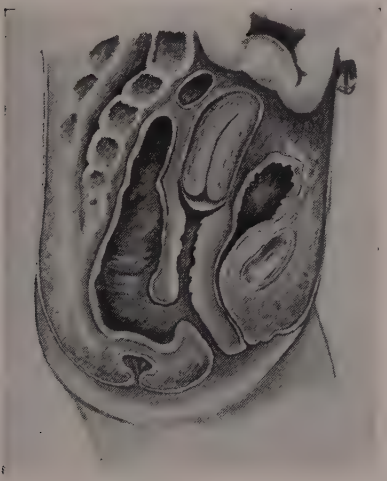


Fig. 4133.—Atresia Ani Vaginalis; – anus blocked – rectum opening into vagina.

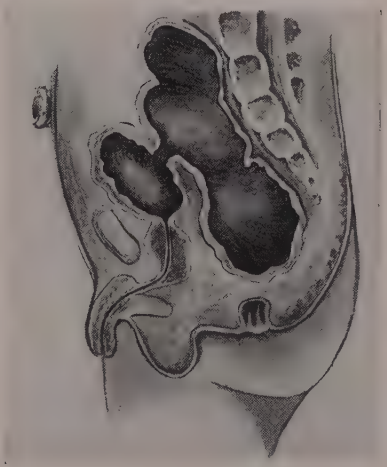


Fig. 4134.—Atresia Ani Vesicalis – the rectum opening into the bladder – the anus blocked.

the abnormal tract, and for the establishment of a fecal outlet in the normal, or in some nearby site.

Atresia Ani Vaginalis – the Anus Blocked – the Rectum Opening Into the Vagina (Fig. 4133).—This is the most frequent rectal deformity,

and the condition constitutes about 50 per cent. of all rectal malformations. Further, patients have gone through the greater part of life, married and had children, without ever knowing that the condition existed, until accidentally discovered. If the opening be sufficient for practical purposes it is probably best not to operate until the child is between three and five years of age. A form of sphincteric control is usually present around the vaginal opening, and, in Rizzoli's operation, it is sought to transplant this, and the rectal pouch, into the position of the normal anus – the perienum having been temporarily cut through to the normal anus, and the posterior vaginal wall incised, the rectal pouch dissected from its pathologic position, including the sphincteric vaginal opening, and implanted at the normal site, after which the posterior vaginal wall is restored and the temporarily divided perineum repaired.

Atresia Ani Uterinæ – or Communication Between the Rectum and Uterus – the Rectum Having No Normal Outlet.—An exceedingly rare condition. No definite line of operative procedure has been worked out in

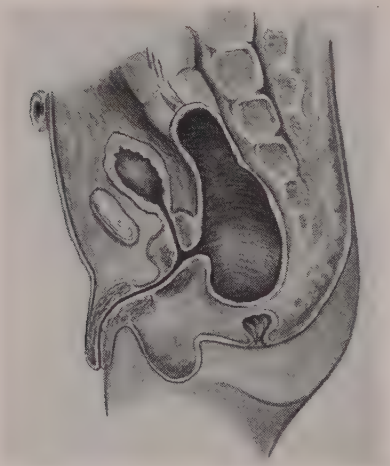


Fig. 4135.—Atresia Ani Urethralis – opening of the rectum into the urethra – the anus blocked.

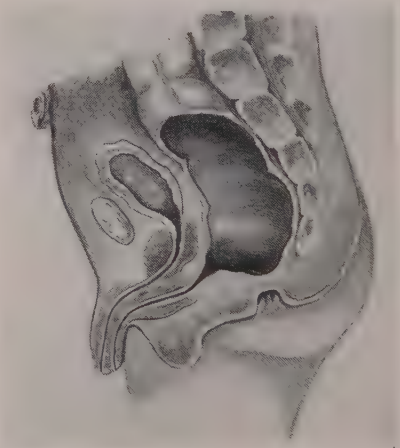


Fig. 4136.—Atresia Ani Preputialis – imperforate anus – opening of the rectum through the glans penis.

these cases – only 2 or 3 of which have been reported. If the rectum cannot be brought down to its normal outlet, a colostomy may be the only other recourse.

Atresia Ani Vesicalis – the Rectum Opening into the Bladder – the Anus Blocked (Fig. 4134).—The indication here is to expose the site of communication by abdominal section – separate the two viscera, invaginating the opening of each viscus into itself, by suturing of raw surfaces – and then to try to draw the rectal pouch down and anchor it into its normal site. Failing in these, colostomy must be performed.

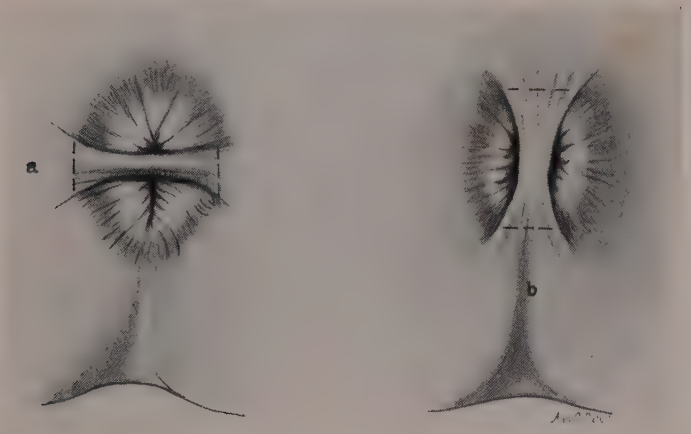
Atresia Ani Urethralis – Opening of the Rectum into the Urethra – the Anus Blocked (Fig. 4135).—These cases are more favorable for operation than the preceding, for the rectal pouch is generally nearer the normal anal outlet. The danger of infection, up to the time of operation, is also less. The pathologic site is exposed by perineal section – the rectum severed from its urethral attachment – and this opening in the rectum is then brought down and sutured into the normal anal site, after incising the barrier to the

anal outlet. The urethral opening, constituting a perineal fistula, left by the division of the communication, usually closes of its own accord _ or, at the time of the separation, a plastic operation may be performed for its closure.

Atresia Ani Preputialis _ Imperforate Anus _ Opening of the Rectum Through the Glans Penis (Fig. 4136).—As in the last considered deformity, the site of communication between rectum and the body of the penis is exposed through perineal section _ the rectal opening dissected from the peneal structure, and bodily brought into the position of the anus, where, after incising the barrier to the normal outlet, it is sutured. The opening into the structures of the penis may be inverted and sutured _ leaving the canal to become obliterated.

OPERATION FOR CONGENITAL PARTIAL OR COMPLETE SUPERFICIAL MEMBRANOUS OCCLUSION OF THE ANUS

Description.—This is the simplest type of congenital partial obstruction of the anorectal outlet. The partial barriers are membranous in nature, and may occur upon the skin aspect of the anal orifice, or within the anal canal,



Figs. 4137 and 4138.—Congenital Partial Membranous Occlusion of the Anus: _ a, Horizontal band, dividing the anal orifice into upper and lower halves; _ b, vertical band, dividing the orifice into right and left halves. The lines of section are shown dotted.

and are in the form of flat ribbons, generally running transversely, anteroposteriorly, or crescentically across the opening. A central or lateral opening for the escape of fluid feces is present.

Operation.—In the case of the longitudinally or transversely running membranous bands partially occluding the anus, all that is generally necessary to do is to excise the central portion of the band by a transverse section at either end _ usually allowing the free edges to shrivel up. This technic is indicated in Figs. 4137 and 4138.

Where the orifice is completely covered by a membrane everywhere adherent (rather than by a band adherent at its ends), a crucial incision through it, directly over the anus, usually suffices _ the orifice made by the cross-cuts being daily dilated by the introduction of a lubricated little finger.

OPERATION FOR ABSENCE OF ANUS WITH PRESENCE OF NEARBY RECTUM

Description.—In these cases there is no vestige of anus present – but the rectum is in some nearby relationship, and, usually, in what would constitute the normal axial line. This condition is the one shown in Fig. 4126 – and is the one to be here dealt with – and to be distinguished from imperforation of the anus, which will be next considered.

Method of Determining the Nature of the Deformity and of Determining the Best Procedure to Adopt.—The best way to determine both of these problems is to cut and learn – and *not* to introduce an exploratory needle and surmise. Damage has frequently been done, the peritoneal cavity entered (a peritoneal pouch intervening between the end of the rectum and the anal site, v. Fig. 4129) by the introduction of a needle for the purpose of drawing off meconium, often guided by no landmarks, but simply by a random shot into the lower pelvis. The lower end of the undeveloped rectum is often not in axis with the normal position of the anus – or, if in axis, not within reach – or, sometimes, in open relation with other viscera – as amply shown in the various illustrations of anorectal deformities (pp. 88–92). Besides, nothing whatever is gained by using an exploratory needle – whether the exploratory puncture ends positively or negatively – for, if negative, it is non-conclusive – and, if any operation is going to be performed at all (and one must be or the child must die), the first attempt is almost invariably made through the perineum. Therefore, in *all* cases the preliminary step is to plan for a deliberate dissection of the perineum – and when this is done, the operative step of incision serves first, for exploration – and then, if correctible, the correction of the defect – which, as a rule, applicable in the vast majority of cases, consists in attempting to find and bring down the blind end of the rectum to the normal position of the anus (sometimes separating it from connected viscera), and anchoring it there. The preliminary use of the needle is unsurgical. (The Writer recalls the incident, a year or two after graduation, where he saved the life of a newborn baby solely through an exploratory needle, and the fact that the child was a girl. The condition of the child was such that it seemed unwise, in the judgment of the leading surgeon of the city, to operate. The Surgeon and the family were warm friends of the Writer, and there was no controversial problem involved – none but the best feeling – and the understanding that if puncture were positive, it would be followed by operation, but not otherwise – an unwise and unsurgical decision, of course. The little hymen was broken down – and the vagina possibly limitedly damaged – a long needle, guided by an intravaginal finger, was pressed through the dome of Douglas' culdesac, in the supposed direction of the rectal terminal pouch – and, happily, withdrew meconium – which positive result was followed by immediate perineal section, prepared for in advance – with the gratifying result of being able to bring the rectum nearly to the skin level. Frequent digital dilatations were kept up by the mother for more than a year – after which no inconvenience was ever subsequently experienced. Entire sphincteric control was established.)

Operation.—Preparation should be made for a deliberate and systematic perineal section – planned, first, to discover the condition of affairs, and then, if possible, to correct them. If the nature of the deformity be not unsurmountable, then the next greatest difficulty common to all cases where it becomes necessary to make a technical dissection of the perineum of a newborn child, is the mechanical one of not having sufficient room in which to work satisfactorily – all the measurements being exceedingly small.

Sometimes the operation is exceedingly simple, as is generally the case

in the type here under consideration – even when discoloration through the skin, bulge of the region upon expulsive efforts, or upon abdominal pressure, and the like, are none of them present. One is considerably aided by having introduced a sound into the male bladder, and a sound or a finger into the vagina, in advance. The median incision should occupy all the available space, from scrotum to coccyx, or from vagina to coccyx. The skin incision is longest, and the subsequent incisions shorter. The tissues are incised layer by layer, well retracted, and examined carefully as the dissection progresses, both by sight and touch. In most of these cases of superficially situated rectal pouches, the blind bulging rectum is soon recognized. The two things most to be on the lookout for are a peritoneal pouch, or a coil of intestine, which may come down between the rectum and the site of dissection – and sometimes be mistaken for the rectum and opened for it. Such possibilities are shown in Figs. 4129 and 4132. The finger or sound in the vagina, or the sound in the male bladder, will be of great service during a dissection which may be proving difficult and uncertain. The bulging rectal pouch is

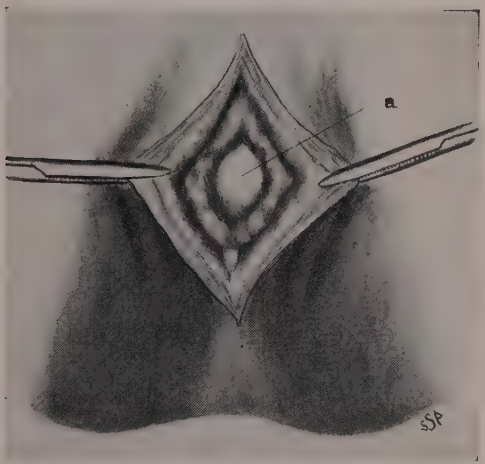


Fig. 4139.—Operation for Absence of Anus with Presence of Nearby Rectum – I; – Exposure of the bulging rectum, **a**, by a median perineal incision.

usually finally encountered, more or less deeply buried in the perineal fibrocellular tissues – as seen in Fig. 4139. After the part is exposed in the wound, it is entirely warrantable to corroborate the presence of the rectal pouch by exploratory needle, if there seems to be necessity for this corroboration.

The located rectal pouch is carefully seized with intestinal clamps and drawn down to the level of the skin of the perineum. This may generally be accomplished in the class of cases being considered, without much trouble – though some degree of mobilization by blunt, as well as scissor dissection, may be required. While the rectal pouch is held in the position it is to occupy, two silk or linen sutures (Fig. 4140, **a, a**) are passed through the perineal wall, parallel with its cut margins, and through the outer coats of the rectal pouch, in the axis of the perineum, and tied. If the bowel is going to be incised at once, as is usually the case, there is no practical reason why these two stitches should not pass entirely through the walls of the rectum. The margins of the wound in front of and behind the anchorage are closed by transversely running sutures (Fig. 4140, **b, b, b**). As there are no peritoneal surfaces to shut off the outlying regions (as in average enterostomies), and

as it would take much longer for connective-tissue adhesions to sufficiently unite to accomplish this, there is usually nothing to be gained (and often

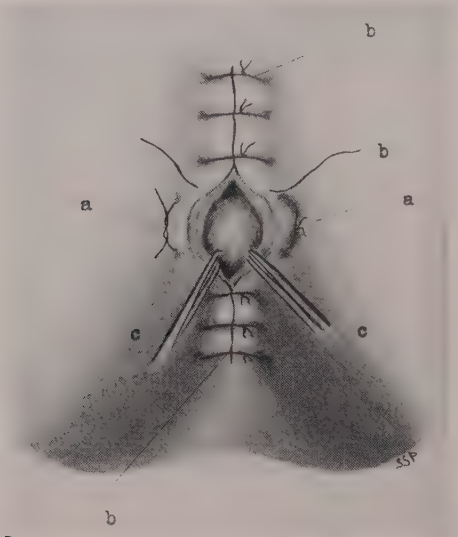


Fig. 4140.—The Same _ II: _ a, a, Sutures anchoring the blind rectal pouch to the margins of the perineal wound; _ b, b, closing sutures of the perineal wound; _ c, c, tractors drawing the rectal pouch into the wound.

much to be lost) by deferring the opening of the bowel. An axial incision, therefore, is usually made at once in the center of the bulging pouch of bowel .

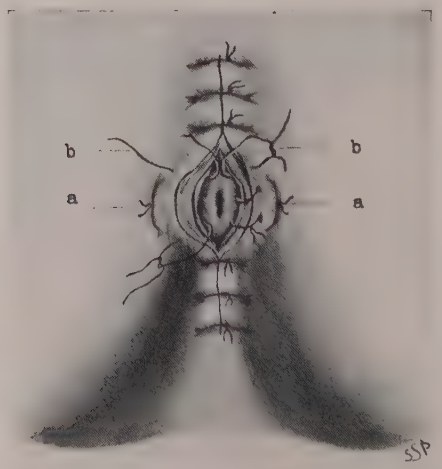


Fig. 4141.—The Same _ III: _ a, a, Anchoring sutures tied; _ b, b, sutures fixing the incised rectal wall into the wound margins.

after making provision for catching the out-pouring meconium, with the minimum soiling of the wound _ and the incised margins of rectum are sutured to the margins of the perineal wound by non-absorbable sutures which pass

through all the coats of bowel and perineum (Fig. 4141, **b, b**) _ three generally being placed on each side. An abundant dressing is applied, which will absorb the bowel contents as fast as passed _ and this dressing is frequently changed.

Comment.—It would seem desirable to adopt here the same plan carried out with an enterostomy, or colostomy, where the opening must be made at once _ after first drawing off the distending meconium with a syringe, to decrease tension _ to make a limited incision in the presenting rectum and tie into the opening a small, flanged glass tube (or, more safely, n a child, a small flanged hard-rubber tube), with attached rubber tubing, so as to conduct to a distance the rectal contents for the first few days _ to prevent soiling of the wound until it is partly shut off by adhesions.

OPERATION FOR IMPERFORATE ANUS, WITH PRESENCE OF NEARBY RECTUM

Description.—In these cases the anus is present either in a rudimentary or perfect form _ and no suspicion may exist that it does not communicate with the rectum until its blind ending is determined by the absence of meconium and by digital examination. The fibrous or mucocutaneous septum which bars communication between the rectum and the anus occurs in varying thicknesses, and is usually situated between 5 mm. and 1 cm. (3/16 and 6/16 inch) from the anal margin (Fig. 4124, p. 88). This is not a condition in which the walls of the rectum are continuous down to the short anal canal, and the continuity of the canal is simply barred by a membrane stretched across _ for that would be of the same general type of condition as that described under congenital partial or complete superficial membranous occlusion of the anus, except that the occluding membrane, instead of being upon the surface of the anal outlet, would be somewhere along the course of the anorectal canal _ and operation for its relief would be of the simplest sort _ generally consisting of crucial incision of the membrane, or better, excision of it, followed by frequent dilatations. In the present condition, however, there is absolute interruption between the continuity of the lower end of the rectum and that of the anal canal _ fibrocellular tissue usually intervening. Where the anus is fully developed the sphincteric apparatus is usually present _ and where the anus is entirely absent, so the sphincteric control usually is. The rectal and anal canals may lie in continuous axis with each other (Fig. 4124), or may be in variation with each other anteriorly, posteriorly, or laterally (Fig. 4765).

Operation.—The anal *culdesac* in these cases is usually normal for from 1 to 1.5 cm. (3/16–9/16 inch) in extent. In those cases in which the anal and rectal pouches are in axial line with each other, or in which there is but little departure from an axial line, it is ideal to anchor the opened lower end of the rectal pouch to the opened upper end of the anal pouch _ although end-to-end union is often very difficult to accomplish. When this method is undertaken, and when it is reasonably concluded, in advance, that the rectal pouch is nearby and in axis, the incision may be made directly through the dome of the anal pouch _ and the lower aspect of the rectal pouch sought and brought down _ and, if possible, it is opened and sutured into the opened end of the rectal pouch.

If there be no guide as to the position of the lower end of the rectal pouch, then the median perineal incision should begin immediately posterior to the anus, and run to the tip of the coccyx (and if more room be demanded, the incision may extend to one side of the coccyx, or the coccyx may be excised) _ and through this incision the rectal pouch be sought, and brought down.

Tuttle dissected away the mucous lining of the anal *culdesac*, and then drew the rectal *culdesac* down through the anal canal and sutured the rectal mucosa to the skin margin. This is not easily accomplished because the rectum is so much the larger.

Matas, in a case where the rectal pouch descended anteriorly to the anal pouch, sutured the free end of the rectal pouch to the perineal margin – leaving the anal *culdesac in situ*, and then incised the septum between the two sacs – constituting a lateral anoproctorrhaphy. Finding that this technic resulted in a larger orifice than needed, and interposed a wedge, posteriorly, which interfered with sphincteric action, he then devised the total excision of the anal *culdesac*, except the marginal anal mucosa, which was left intact – and to this he sutured the mucosa of the rectal *culdesac*.

OPERATION FOR ABSENT OR IMPERFORATE ANUS WITH THE RECTUM ARRESTED HIGH UP IN THE PELVIS

Description.—In these cases the anus may either be entirely absent, or present and perfect, though ending in a blind pouch – and the rectum arrested in some position high up in the pelvis. The surgical problem then is to find the lower end of the rectal pouch, bring it down, and connect it up with the already present perineal anus, or connect it with a new anal outlet – or, failing in these, provide some other outlet for the intestinal tract, such as a colostomy.

Operation.—The manipulative difficulty to be expected in operating in the deep pelvis of infants will be appreciated from the following average measurements given by Tuttle: – Between the ischial tuberosities, $1\frac{1}{2}$ to 2 cm. ($\frac{5}{8}$–$\frac{3}{4}$ inch); – between the scrotum and the coccyx, from 4 to $4\frac{1}{2}$ cm. ($1\frac{9}{16}$–$1\frac{3}{4}$ inch); – between the posterior commissure of the vagina, and the tip of the coccyx, from 3 to 4 cm. ($1\frac{3}{16}$–$1\frac{9}{16}$ inch); – between the anus and the tip of the coccyx, about $1\frac{1}{2}$ cm. ($\frac{5}{8}$ inch); – between the tip of the coccyx and the sacral promontory, the depth of the pelvis, about 6 cm. ($2\frac{3}{8}$ inch). This gives an elliptic working space, with an outside length of 4 cm. ($1\frac{9}{16}$ inch), and an outside width of 2 cm. ($\frac{3}{4}$ inch). The average distance of the peritoneal pouch, from the perineum, in females, is about 2 cm. ($\frac{3}{4}$ inch) – and, in males, from $2\frac{1}{2}$ to 3 cm. (1–$1\frac{3}{16}$ inch). These normal averages may be considerably altered by the presence of bony deformities in addition to the anorectal deformities.

No exploratory use of needle or trocar is warrantable at any stage short of the actual exposure of the rectal pouch in the wound.

A straight median perineal incision is made, beginning, if there be no anus, at the anterior margin of what would be the normal site of the anus (or even at the base of the scrotum, or at the posterior commissure of the vagina) – and extend backward to the tip of the coccyx. Where there is a rudimentary anus the incision should begin at its posterior margin. In carrying the incision posteriorly, the external sphincter should be split, and carefully preserved, rather than divided, its two halves being guardedly separated. The incision passes through skin and subcutaneous tissue, and the dissection, which is partly blunt and partly sharp, by snips with Mayo scissors, is carried in a backward direction corresponding with the curve of the hollow of the sacrum, and avoiding wounding all viscera. If, fortunately, the rectum be encountered, it is seized with delicate rubber-covered clamps and drawn down. If held by attachments, these are divided. Sometimes, if considerably distended, the pouch can be better drawn down after the contents are aspirated (which is legitimate after the organ is in the field). The wound made by the aspirator can be tied with a puckering ligature to keep from soiling the wound. When the pouch has been drawn down, and all is in readiness to catch the in-

testinal flow, the blind end of the rectum is incised, and the mucous membrane sutured to the skin – with stitches, at intervals, penetrating all the coats of the rectum and the margins of the perineal wound. Some Surgeons suture only the mucosa to the skin, letting the other coats retract. The perineal wound is thus partly protected from soiling. If the rectum cannot be made to reach the cutaneous aspect of the perineal wound, it is anchored as near to it as possible.

Vincent, in order to secure a broader surface to which to attach the mucosa, cut two elliptic skin-flaps from each side of the perineal wound.

The excess of perineal wound is closed with deeply running sutures, which also bring together the two split portions of the external sphincter muscle.

If, instead of encountering the rectum at some moderately low level, it is arrested in the upper part of the pelvis, the above comparatively simple procedure may be rendered much more difficult. It is very likely that more room for manipulation will be required, and this is most easily (though difficult at best) secured in the direction of the hollow of the sacrum. This additional room is best gotten by medially splitting the coccyx and lower sacrum with scissors (which is easily done in infants), and then laterally retracting these parts – and in this way the muscles of the anus and rectum are preserved. The rectum, when encountered, may not be made to reach the perineal site of its normal outlet – and, in such cases, the cartilaginous portion of the mid-aspects of the split coccyx and sacrum may be dissected out (to prevent the subsequent formation of bone) and the rectum anchored between the split portions of the sacrum thus prepared – the perineal wound being elsewhere closed.

If the rectum is not located in the hollow of the sacrum one must continue the search further upward and forward as well as laterally. It may be attached to the sacral promontory by entirely enveloping peritoneal folds – and have to be enucleated, if this can be accomplished, before it can be brought down. Sometimes the peritoneum must be opened, through the pelvic wound, before the rectum can be delivered – and, in such cases, is carefully sutured before the rectum is anchored and closed. In other instances the difficulties are insurmountable, and an abdominal colostomy must be performed. In such a contingency the pelvic wound is sometimes packed, so that it may be possibly used some days later, when the rectum may descend of its own accord, or be then brought down.

Where the anus is well developed, one may try to make an end-to-end anastomosis, which is difficult to accomplish. Failing in this, one of the methods mentioned under the operation for imperforate anus, with a nearby rectum, p. 97, may be carried out.

Comment.—A sound in the bladder, or in the vagina, may be of considerable help during difficult dissections.

If a fibrous band attached to the anus be discovered in the dissection, it should be carefully followed upward, as it almost certainly leads to the blind end of the rectum.

According to Keith's estimate, it is possible to bring the rectal pouch down to the perineum in 95 per cent. of cases.

One may be aided, in seeking for the rectal pouch during dissection, by having counterpressure made upon the abdomen – the fluctuant rectum being thereby sometimes located.

Edwards concludes that if the rectum be not discovered after the dissection has been carried to the depth of 5 cm. (2 inches), inguinal colostomy should be performed. If the wound be packed for a time, the rectum may come down, or be found and brought down later

Sometimes the peritoneum is deliberately opened through the pelvic wound, working upward and forward, the rectum located and brought down, the peritoneum closed, and the rectum then anchored in the perineum.

The earlier operations of this kind are performed, the better – and without anesthesia, as infants bear the operation better without it.

SECURING RECTAL SPECIMENS FOR EXAMINATION

It is often necessary to procure, for examination, portions of tissue from within the rectum – either portions of elevated growths or of ulcerated surfaces – especially where the question of malignancy is in the balance.

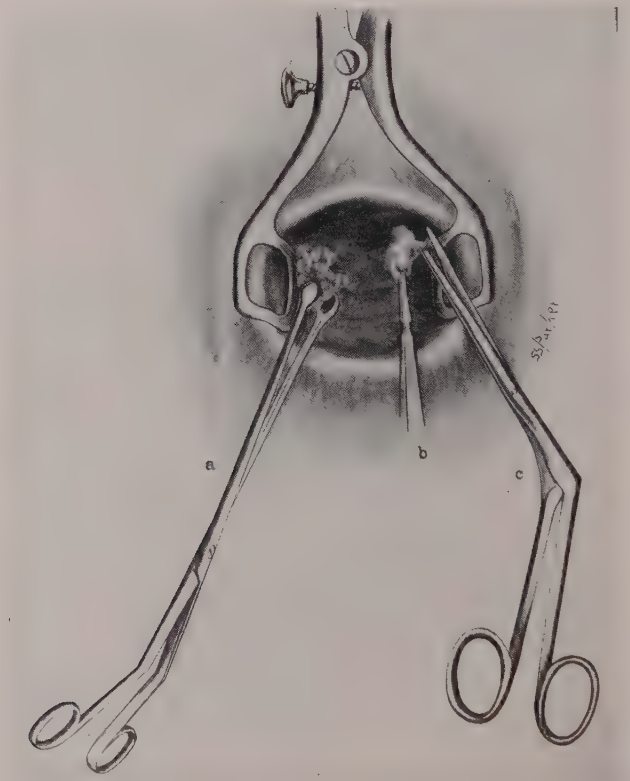


Fig. 4142.—Securing Rectal Specimens for Examination: – a, Taking part of a rectal growth by means of specimen forceps; b c, removal of a rectal polyp, grasped by forceps, by means of specimen scissors

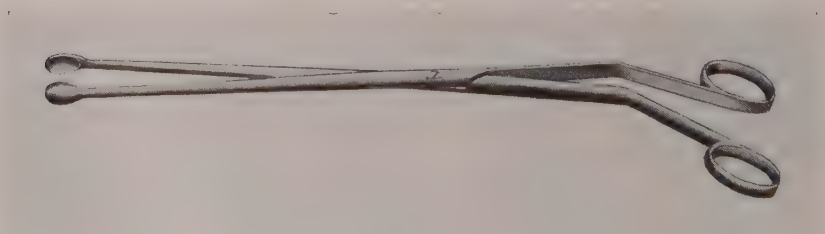


Fig. 4143.—Tuttle's Rectal Specimen Forceps (Redrawn from Tuttle.)

In Fig. 4142 is shown such an examination being conducted with a fenestrated bivalve speculum with the patient in the knee-chest position – although the procedure may be carried out in any of the postures already described. On the left a portion of a cauliflower-like growth is being removed with Tuttle's specimen forceps (Fig. 4143) – while, on the right, a small, peduncu-

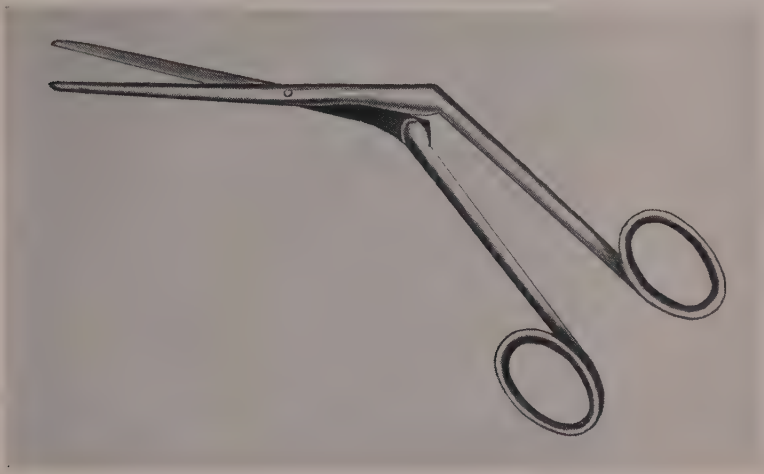


Fig. 4144.—Tuttle's Specimen Scissors. (Redrawn from Tuttle.)

lated tumor, steadied by forceps, is being cut off by means of Tuttle's specimen scissors (Fig. 4144). (In this latter part of the illustration the tumor should be grasped by operating forceps rather than by laboratory forceps).

OPERATIVE RELIEF OF RECTAL CRYPTITIS

Description.—The rectal crypts and valves of Morgagni sometimes become the site of inflammation, infection, ulceration, distention, and the like – and frequently serve as the starting-point of fistulæ and fissures. These conditions are met by exposure of the parts, followed by applications, incision, or excision.

In determining the nature of the condition, the anorectal outlet is carefully examined by a windowed speculum, bivalve speculum, or a single bladed speculum which will displace the opposite walls, in turn, thus exposing the entire anorectal circumference. If the patient be lying in the left lateral position, while the left half of the circumference of the anorectal wall is being examined by a univalve speculum, exposing the crypts and valves of Morgagni of the opposite side – a bent probe can usually be passed down to the bottom of one of the crypts.

Operative Measures.—The investigation of the special condition is made by straight and bent probes – the former serving to pass upward into a submucous fistula having its origin in a crypt – and the latter, for examining the bottom of a crypt (Fig. 4145, **a** and **e**). Sometimes it will be found that a crypt has been entirely broken through, or ulcerated, by distention (**Fig. 4145, c**) until nothing but the remaining furrow is left (Fig. 4145, **b**). In making applications to diseased surfaces a pledget of cottom may be twisted upon a straight, or bent probe, dipped into ichthyol, carbolic acid, tincture of iodin, and the like, and carried directly to the surface to which it is to be applied.

In adopting radical measures, analgesia usually suffices. The distended crypt may be seized with forceps, at its site of bulging, which is usually its lower end, and the distended lower end excised, thus furnishing dependent drainage (Fig. 4145, d). Or the entire crypt may be incised – or excised – throughout its full length.

Sometimes anesthesia is employed, and the anorectum stretched, in advance of any technical procedure upon the crypts.

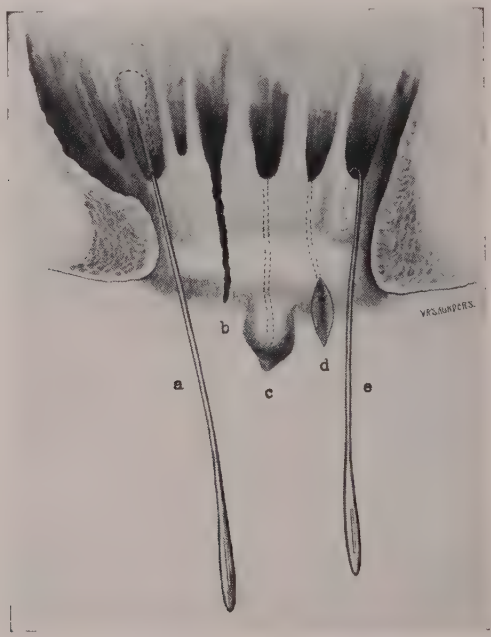


Fig. 4145.—Fistulæ and Fissures Originating in the Crypts and Valves of Morgagni: – a, Probe in submucous fistula arising from a crypt; – b, a crypt which has been torn down under distention and pressure; – c, distended crypt; – d, distended crypt with protruding part excised, showing the opened tract; – e, bent probe examining a cryptic pocket.

Following operation, local applications and irrigations are usually made daily.

REMOVAL OF PEDICULATED TUMORS OF THE LOWER RECTUM BY PROGRESSIVE SECTION AND SUTURE

DOYEN'S TECHNIC

Description.—*Pari passu* with the freeing and dividing of the pedicle of the tumor, its base is sutured.

Operation.—If the tumor is low enough to enable its pedicle to be exposed by manually or instrumentally everting the mucosa of the anus, the operation may be performed under analgesia – otherwise, anesthesia is used, and the anorectal canal dilated. The tumor is exposed and further drawn down by a clamp forceps. Beginning at the uppermost aspect of the pedicle, the pedicle is, step by step, freed by an elliptic incision, beginning just above and ending just below the pedicle, and, at its middistance, arching up somewhat on to the pedicle. As the cuff of mucosa thus raised is pushed back, the pedicle itself is divided by knife or scissors – and at once sutured. If a vessel of any size is divided, it is picked up with a hemostat and ligated. Finally,

the last part of the pedicle is divided, and the mucosal flap immediately sutured over it. The technic is shown in Fig. 4146.



Fig. 4146.—Removal of Pediculated Tumors of the Lower Rectum by Progressive Section and Suture.

Comment.—Where this method is feasible, it is more surgical than the usual practice of simple ligation and excision of these tumors – for no raw surface, unprotected by suturing, is left for more ready infection.

INSTRUMENTAL AND OPERATIVE REMOVAL OF FOREIGN BODIES WITHIN THE RECTUM

Description.—An endless variety of objects may be found in the rectum – one category being made up of any of the insoluble objects which may be swallowed and, strangely enough, succeed in getting down as low as the rectum before being finally arrested – the other category, consisting of objects introduced into the rectum from below, such as may be found in patients of unsound mentality, or among those who introduce objects as part of a fetish worship, or again among such primitive people as those who are reported as corking up their anorectal orifices with clay plugs after each movement.

Instrumental or Operative Removal.—So varied in nature are the cases encountered that the handling of each one must be met on its own merits – and the individual Surgeon's ingenuity.

On general principle, it may be said that small objects can usually be removed without analgesia, or anesthesia, through a tubular, or dilating anorectal speculum, or sigmoidoscope, – whereas, larger objects, especially those tightly filling the rectum, or those of such nature as likely to damage the rectum, or anorectum, in their removal, are best removed after the patient has been anesthetized, and the anorectal orifice carefully dilated. The general guidance as to what maneuver should be adopted is usually secured by digital examination, or by *x*-raying. Broken glass is particularly hard to remove

without injuring the rectal wall with the glass. Small objects can often be picked up with forceps and readily dislodged and withdrawn. Larger objects can sometimes be carefully broken up by means of strong forceps, and then removed piecemeal. Objects may lodge behind (above) the valves of Houston, and, thereby, be difficult to locate. Sometimes a deliberate limited internal rectotomy must be performed – as an alternative to the unintentional, extensive and irregular rectotomy, or even divulsive laceration likely to result through persistent efforts to remove some unusual body through an opening unable to accommodate it.

Several cases have been reported where elderly colored people have, under the influence of religious fervor, or voodooism, introduced remarkably large bottles into their rectal canal. In a case of this nature which came under the Author's observation, when an Intern of the Charity Hospital, New Orleans, an old, half-witted negro, had taken a bottle, a beer-bottle, or its size, as nearly as can be remembered – cleverly broken out its bottom, without fracturing its sides, and had then introduced it, the uncorked, neck-end first, into his rectum – until the entire bottle had completely disappeared. He claims to have worn this for some considerable time – defecating through its open lumen. Finally, troubled by perianal ulceration, he came to the hospital. Appearances bore out the probability of its having been *in situ* some length of time. The anorectum was dilated, and the bottle safely extracted.

INSTRUMENTAL AND OPERATIVE TREATMENT OF FECAL IMPACTION

Fecal impaction most frequently occurs in the ampulla of the rectum, fortunately – where its presence is readily recognized. It may also occur in the cecum – and at the hepatic, splenic, and sigmoid flexures – and, indeed, the whole large intestine may be filled with concretions.

In all forms of fecal impaction the effect of repeated – prolonged – and patient irrigation should be thoroughly tried out, before resorting to other measures. The certain easy return of all water thrown into the bowel must be absolutely assured in advance – and if free exit for the outflow of the fluid be provided, there is no possibility of having fluid accumulate above the impaction, and the impaction serve as a ball-valve against its escape. Even when the impaction is within a few inches of the anus, and the tip of the tube at first buries itself in the fecal mass, irrigation is still indicated – and, indeed, in such cases sometimes acts as the stream of water does in hydraulic mining – by breaking up the mass, or starting the mass to break up, or soften down its exterior which then comes away in washings, with the constant loss of size of the mass. In the higher impactions removal by irrigation is harder – but even here success often follows its use. Ordinary soapsuds and warm water may be, and generally is, employed. The lubricant effect of the soap is good – and the injection of sweet oil, as high as it can be deposited, is also excellent, for the same reason. Sometimes agents which will excite expulsion are included in the irrigating fluid – such as glycerin, ox-gall, turpentine, and the like – but it is probably best to resort to nothing which has an active force, in the presence of doubt as to the nature and extent of the impaction – that the bowel may not be excited to marked action to remove a barrier beyond its power to overcome, and, possibly, suffer rupture. The Author has had one case, the result of marked obstipation from prolonged contact with lead (in the person of a painter), where faithful irrigation during two days brought no result, and operation was planned – when, in conjunction with irrigation, the concretions were largely expressed by massage of the abdomen

at intervals _ as the placenta is expressed from the wound by manual manipulation.

Two-way irrigations may be employed for delivering and removing the irrigant _ but the Writer has always employed a simple fenestrated rectal tube having both terminal and lateral openings (Fig. 4147). After this is inserted as far as it will go without doubling, the fluid is delivered in relays, from a reservoir about 3 feet above the level of the patient _ detaching the nozzle of the irrigator from the rectal tube for the back _ wash _ for in this way a controlled degree of intestinal distention could be assured.

If such means as these fail, and the impaction be within the rectum and within reach, an attempt may be made to break up, or start the disintegration of the nearest fecal mass by the introduction into it of the gloved finger. Failing in this, a special rectal spoon or scoop may be introduced alongside of the finger and manipulated so as to break up the mass and mechanically remove it. Or a rectal speculum may be inserted, accompanied or not by anesthesia, and the mass be then dug out with the scoop, through the speculum.

If the impaction be higher, as in the flexures of the colon, or cecum, and all other means be tried and fail, abdominal section may have to be undertaken. If the abdomen be opened, the procedures, in the order of their desirability, are, _ the manual removal of the impaction, by pressing the bowel contents onward, downward, and out through the anus, without incising the

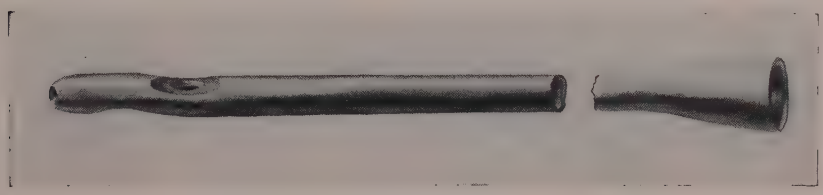


Fig. 4147.—Rectal Tube.

intestine, _ colotomy, with the removal of the fecal concretions, and suture of the colonic incision, _ colotomy, followed by the removal of the concretions, and the establishment of a temporary colostomy.

In the case of a woman, with lower rectal impaction, much mechanical aid may be secured by using her vagina as a portal of entry for downward digital pressure directed against the obstructing mass.

VALVOTOMY OF THE VALVES OF HOUSTON FOR FECAL OBSTRUCTION

Description.—Sometimes the valves of Houston are so much hypertrophied as to become the source of some degree of mechanical obstruction to the passage of feces through the lumen of the rectum. This obstructive form of valvular development sometimes causes obstipation, or fecal impaction. This condition is often very much improved or entirely relieved by the cutting of these valves. Before being subjected to section the valve is tested by means of a blunt hook _ a normal valve offering little or no resistance to being drawn down by the crook of the hook, whereas a very much hypertrophied or chronically inflamed and infiltrated valve may offer considerable resistance. Various methods for dividing the valves have been devised _ some acting by pressure necrosis, others by direct section.

Division of Houston's Valves by Direct Section _ Martin's Technic.—The patient is in the knee-chest position, and a tubular form of rectal speculum of about 3 cm. ($1\frac{3}{16}$ inch) diameter is introduced. The valve is then steadied

by means of two sharp-pointed, crooked tenacula, which transfix its substance on each side of the line to be incised, which is the center of the valve. To tell



Fig. 4148.—Martin's Method of Incising Rectal Valves by Means of Special Knife and Tractors – the tenaculum tractors steadying the valve margins.

to what depth the valve must be incised curve the end of a uterine sound to three-quarters of a circle – introduce the curved sound above the valve, and

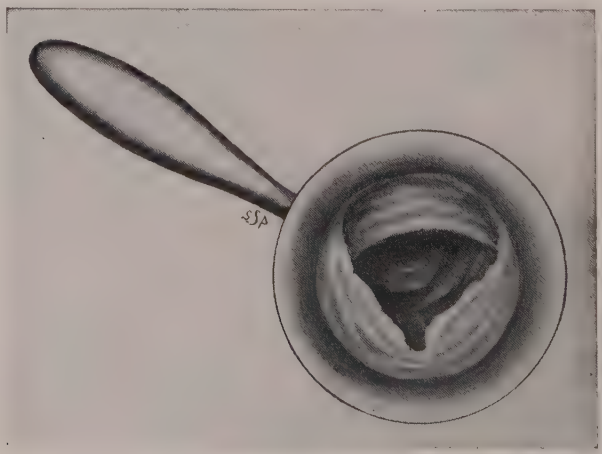


Fig. 4149.—Rectal Valve after Incision by Martin's Method.

learn the exact site at which the point of the sound is arrested when it is attempted to draw it downward. The valve should be cut up to this point. When

all is ready, the valve is held out in the lumen of the bowel, at a right angle to the wall of the rectum – and the incision is begun by Martin's sharp-pointed bistoury, after which it is completed by his scalpel. The technic is shown in Fig. 4148. It is seldom necessary to suture the edge of the incision to control



Figs. 4150 and 4151.—Gant's Clamps: – a, Colostomy clamp; – b, clamp for Houston valve.

hemorrhage – for which he has also devised special instruments. The appearance of the valve subsequent to operation is shown in Fig. 4149.

Valvotomy by Gant's Clips.—The form of clip here employed is that shown in Fig. 4150, **b**. The clip is held in a special form of applicator (Fig.



Fig. 4152.—Gant's Valve Clamp and Valve Clamp Applicator – the clamp is grasped and opened ready for application upon the rectal valve.

4152). The patient is in the knee-chest position, and the valve is exposed by a tubular speculum. The valve is located and tested as to the degree of obstruction caused by it – after which the opened clip, clamped in the applicator, is applied to the valve, and released (Fig. 4153). A clip may be applied

to more than one valve (Fig. 4154). The appearance of the part following pressure necrosis is seen in Fig. 4155.

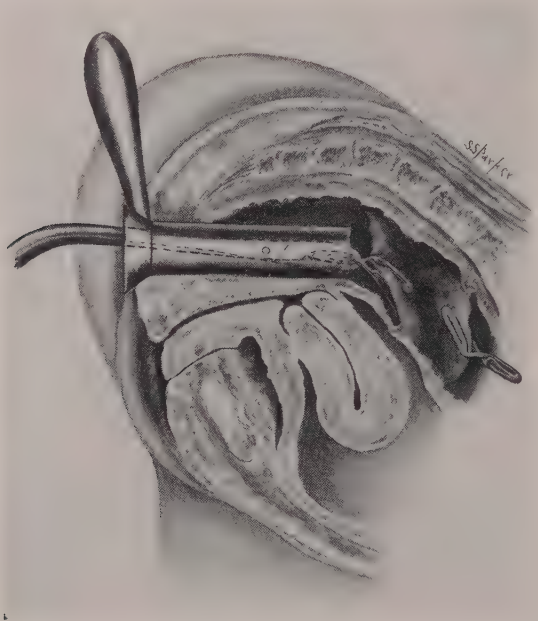


Fig. 4153.—Gant's Technic of Valvotomy with Special Clamp and Clamp Applicator.

Valvotomy by Pennington's Clips.—The technic of applying Pennington's special form of clip, as well as the clip itself, is seen in Fig. 4156.

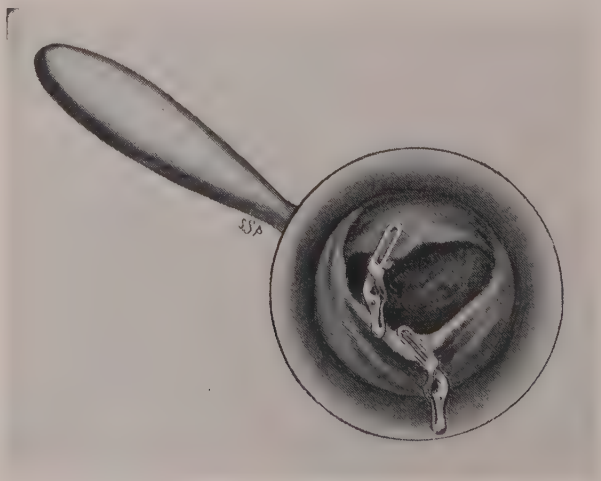


Fig. 4154.—Application of Gant's Rectal Clips

Valvotomy by Lynch's Electric Valvotome.—In this method of removing valvular obstruction the valve is burned through by a special form of electric clamp (Fig. 4157).

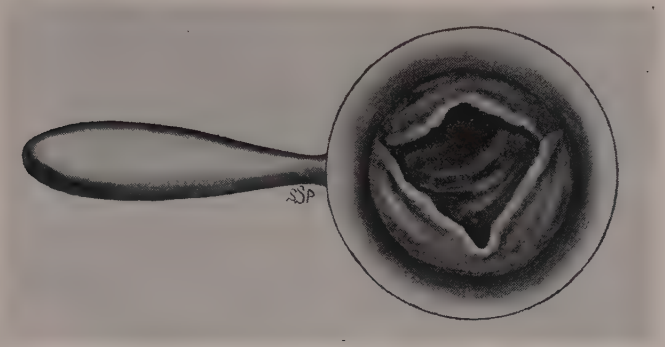


Fig. 4155.—Rectal Valve After the Application of Gant's Clip.

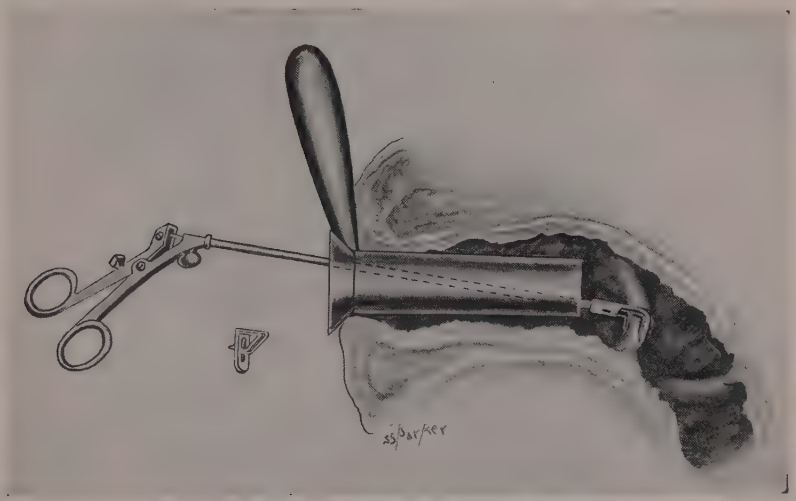


Fig. 4156.—Rectal Valvotomy by Means of Pennington's Clips; Application of a clip, by special forceps, with the patient in the knee-chest position.

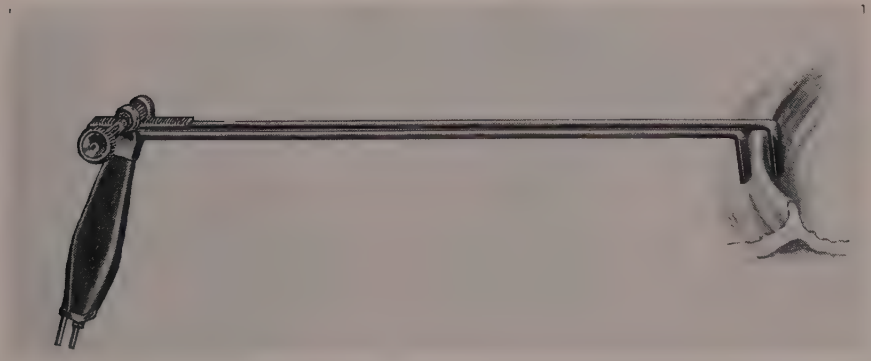


Fig. 4157.—Dividing Rectal Valve by Lynch's Electric Valvotome.

Valvotomy by Hirschmann's Rubber Ligature.—A solid rubber cord is carried through the valve by means of a hollow valvotomy needle (Fig. 4158), after which the end of the ligature is drawn out with special forceps

and the needle withdrawn. A lead bead is slipped over the ends of the rubber cord – and on down toward the valve, by means of special clamp forceps

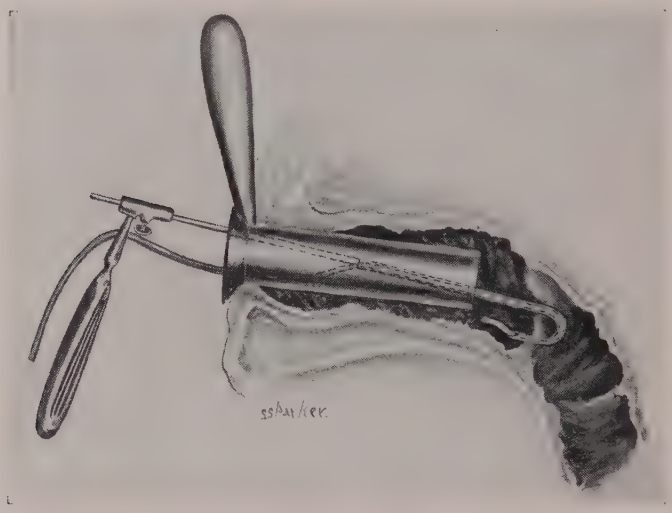


Fig 4158.—Hirschmann's Valvotomy with Rubber Cord – by means of his tunneled ligature carrier

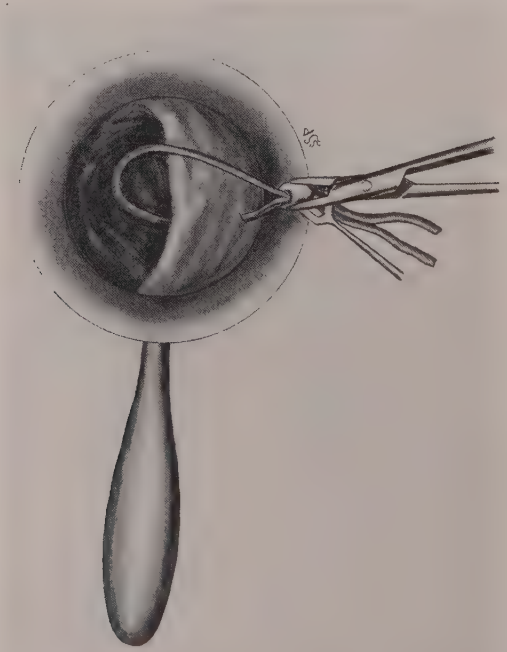


Fig. 4159.—Hirschmann's Rectal Valvotomy – about to clamp the rubber loop, when taut, with a lead bead.

(Fig. 4159). When the ligature has been tightened sufficiently to cause pressure necrosis of the valve, the lead bead is clamped – and the ligature ends cut.

REPAIR OF THE SPHINCTER ANI FOR FECAL INCONTINENCE

Description.—It has frequently happened that incontinence of feces has followed operations for fistula in ano, especially where the sphincter has been divided obliquely, or in more than in one place, or where the ends of even a single, correctly made incision heal with a wide stretch of scar tissue between them. The object of operation in such cases is to restore to the normal, as nearly as possible, the musculature of the part. Several operative procedures are in use to this end.

Operation by the Excision of a V-shaped Portion of the Sphincteric Scar, Followed by Suture of the Sphincter _ Tuttle's Technic.—The method of excising a V-shaped portion of the cicatricial area, including the ends of the sphincter, with the base of the V pointing inward (Fig. 4160, the dotted figure), is the method which has been most frequently carried out. Tuttle contended that excision of scar tissue through such an incision as this neither shortens the muscle to any appreciable extent (which is one of the chief indications of the operative treatment), nor leaves muscle margins which can most satisfactorily be brought together. In its place, therefore, he suggested the reversed V-shaped incision, with the base of the V pointing outward, with a short right-angle incision added to the outer end of each limb of the V (Fig. 4160, the solid figure). The separated, more or less distorted ends of the sphincter are thus cut squarely across, and two much more approximable aspects of the muscle are left.

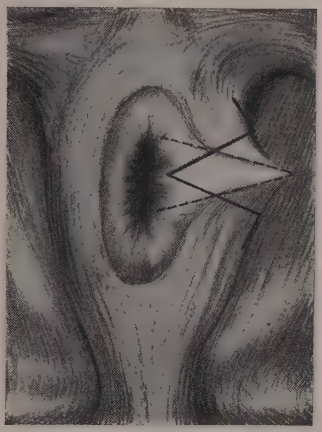


Fig. 4160.—Methods of Excising Scar Tissue in the Sphincter, Resulting from Former Incorrect Division or Malunion; _ V-shaped incision, with apex outward; _ V-shaped incision, with apex inward, crossing the muscle at a right angle, with added right-angled incision at the free ends, if necessary.

The exposure of the part is best accomplished by a crescentic incision, with outward convexity, placed over the scar and a short distance outside of, and parallel with, the anal orifice _ the exact placing of the incision depending upon the size and nature of the scar. The overlying skin and mucosa are retracted. After excising the scar tissue, the transversely divided ends of the sphincter are mobilized by dissection, sufficiently to bring them into easy contact _ and then approximated by buried chromic catgut sutures _ squarely approximating end to end. Any accidentally divided mucosa is carefully sutured. In order to relieve the tension upon the direct muscle sutures, Tuttle advised a silver wire, or catgut relaxation, or tension-relieving suture, through the divided muscle, outside of the sutures of approximation, and tying it over a pledget of gauze overlying the wound, after the wound has been sutured. The bowels are kept constipated for six to eight days, and the patient in bed. If the sphincter has been divided in more than one place, the repair of only one site is made at a time. If care be taken not to divide the mucosa, much less danger of infecting the wound will follow.

Operation by Simple Excision of the Sphincteric Scar Followed by Suturing _ Mayo-Robson's Technic.—This procedure was suggested by Mayo-Robson for relaxed and paralyzed anal sphincter _ and, when applied to an old scar, consists in making a semilunar incision over the involved site,

and just outside of the mucocutaneous juncture (Fig. 4161). The dissection is carried down to the sphincter – the mucous flap being retracted inward,

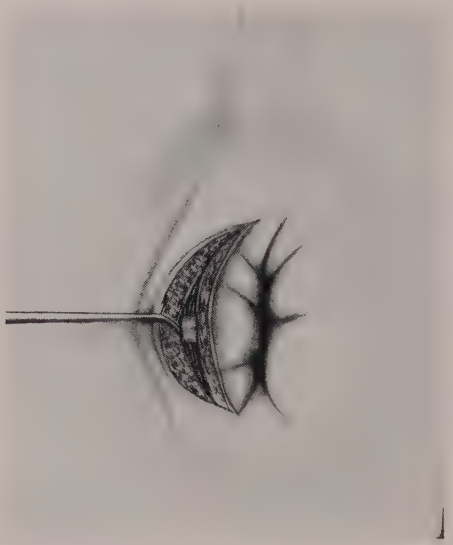


Fig. 4161.—Mayo-Robson's Operation for Fecal Incontinence Following Fistula Operations – I; – Crescentic incision just outside of the mucocutaneous junction. At the bottom of the retracted incision is seen the lesion of the sphincter.

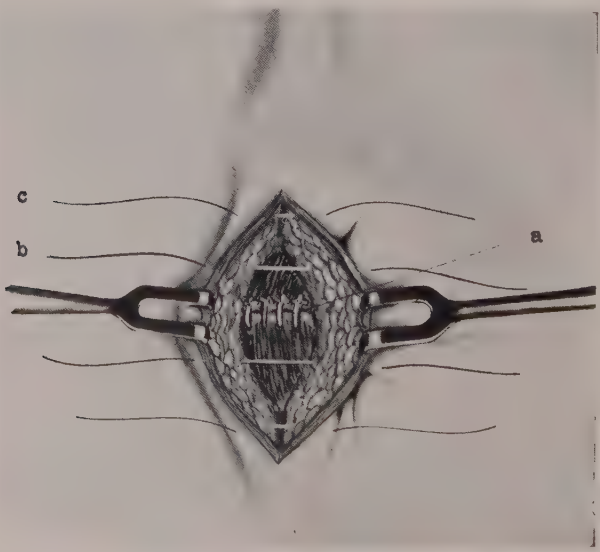


Fig. 4162.—The Same – II; – Closing the wound: – a, Deep muscle sutures, uniting the freshened edges of the sphincter, following excision of the scar tissue; – b, skin and connective-tissue sutures, coaptating the deeper portion of the wound; – c, same, through more superficial part.

and the cutaneous flap outward. The scar tissue is excised, with the adjacent margin of muscle – and the ends of the muscle brought together by buried chromic catgut sutures (Fig. 4162) and the skin wound sutured.

Operation for Newly Lacerated Sphincter Ani, Complicated or Uncomplicated with Laceration of the Perineum, Occurring in Labor.—This condition is described in the operations performed in connection with pregnancy (v. Index, Vol. VI).

Operation for Long-standing Fecal Incontinence with Atrophied Sphincteric Musculature – Chetwood's Technic.—Sometimes the damage done to the sphincteric apparatus, generally due to operation, or to extensive destruction, is so great, or the time of its continuance so long, that the musculature undergoes retrograde change, in the direction of atrophy, increasing its disability. In the anoplastic procedure suggested by Chetwood, an almost

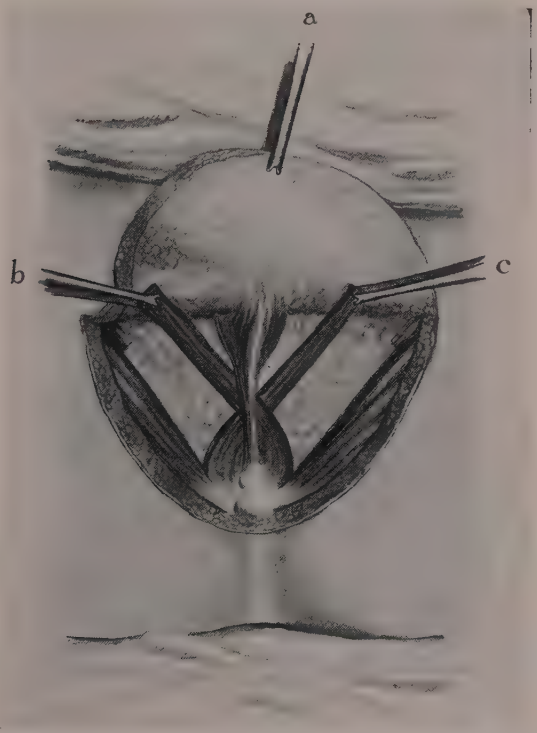


Fig. 4163.—Cheetwood's Operation for Fecal Incontinence Following Fistula Operations – I: – a, Flap turned upward from semicircular incision extending from tuberosity to tuberosity and beyond the coccyx; – b, c, bands of muscle tissue cut from the gluteus maximus of each side and crossed beneath the anococcygeal ligament ready to surround the anus and sphincter ani when crossed. (Modified from Tuttle.)

semicircular incision is made, with backward convexity, extending from one tuberosity to the other, and backward to or slightly beyond the coccyx. This extensive flap of skin and connective tissue is dissected up, down to the plane of the sphincteric muscles and margins of the glutei, and displaced forward, exposing these muscles. From the inner border of each gluteus maximus a strip of muscle tissue, 6 mm. ($\frac{1}{4}$ inch) wide, and 1.5 mm. (1/16 inch) thick, is raised, separated from the muscle everywhere except at their coccygeal attachments (Fig. 4163). These two ribbon-like, muscular bands are now made to cross each other under the remains of the external sphincter and the ligamentous tissue between the anus and the coccyx – after which they surround

the rectum — and their ends are brought together in front of the rectum, and sutured under the bridgework of skin and connective tissue, which has been here tunneled, by blunt dissection, for the purpose (Fig. 4164). The sides of the gluteal strips are also sutured to the remains of the sphincter, where it surrounds the rectum. Finally, the semilunar flap is turned back in place

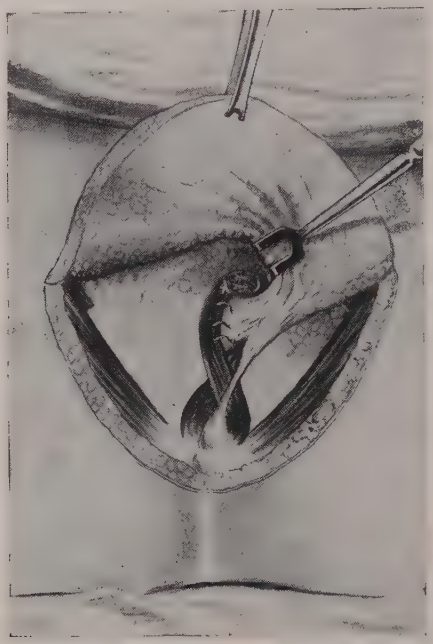


Fig. 4164.—The Same — II; — Having crossed the cut ends of the glutei maximi beneath the ano-coccygeal ligament, they are carried around the rectum, encircling it and meeting in front — a path having been made by blunt dissection, while the overlying flap is well retracted. The free ends of the muscle slips are sutured together and the junction reinforced by a mattress-suture. The raw margins of the split gluteal bands are sutured laterally to the sphincter muscle. (Modified from Tuttle.)

and sutured — and a compression dressing applied, which will hold the somewhat extensive flap into contact with the underlying parts during union.

OPERATION FOR PRURITUS ANI BY SUBCUTANEOUS DIVISION OF THE SENSORY NERVES

LYNCH'S TECHNIC

Description.—Pruritus ani is not an entity, but the symptom of some condition — manifesting itself by a more or less intense, and more or less intermittent itching of the perianal skin — generally followed, in marked cases, by a pathologic change in the skin, due in part to the traumatism of scratching and rubbing. Whichever of the many possible causes may be in action in the particular case, the irritability is expressed in the sensory nerves of the perianal region — and the operative measures directed toward the relief of the condition have for their object the interruption of the sensory nerve tracts of the parts. In Lynch's operation the sensory nerves of the perianal region are completely divided subcutaneously.

Operation.—The procedure is performed under analgesia — with the patient lying upon his left side, with legs and knees drawn up. Two points are selected, directly opposite the anus, one on each side, and at about 3.2 cm.

($1\frac{1}{4}$ inches) from the anus – and from these two sites the analgesic solution is injected in different directions – as shown in Fig. 4165. In the site of needle punctures two small straight incisions are made, parallel with the midperineal line, passing through the skin, into the connective tissue, but not through the latter. The points of a pair of blunt-pointed scissors, curved on the flat (the Mayo type is most convenient), are carried through each incision, in turn. A blunt dissection is now made in the connective-tissue plane, working to the anus, in the middle; to the anterior raphé in front; and to the posterior raphe behind – completely severing the sensory nerve filaments of both sides throughout a circular area of about 3.7 cm. ($1\frac{1}{2}$ inches) all around the anus. Bleeding is usually insignificant, and readily controlled by pressure. Each wound is temporarily drained with a small rubber tube for twenty-four hours. The

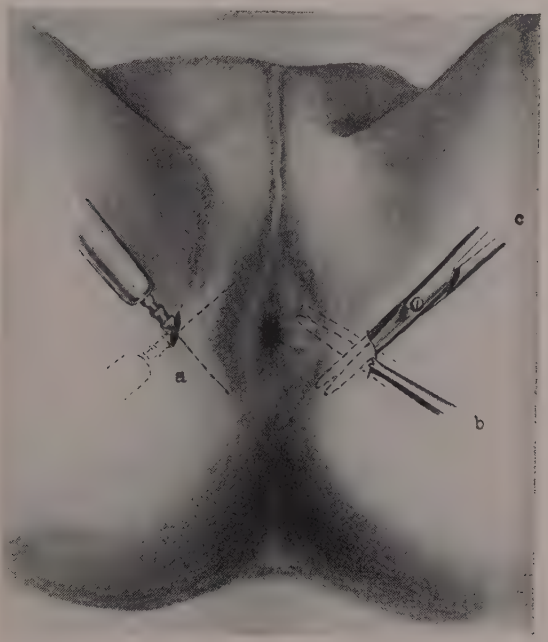


Fig. 4165.—Lynch's Operation for Pruritus Ani: – a, Incision through which the hypodermic needle is introduced in various directions to produce analgesia; – b, forceps steadying the lip of the original wound, through which scissors, c, are now introduced in different directions through the connective-tissue plane in the division of the nerve supply. (Modified from Lynch.)

small wounds do not actually require closing – but if a suture has been placed at the time of the operation, but then left untied, it may be tied when the two small drains are withdrawn.

One side may be done at one sitting – and the opposite side at the next – or both may be done at the same time.

If relief is not permanent it is at least apt to last for two or three years.

OPERATION FOR PRURITUS ANI BY OPEN SECTION OF THE SENSORY NERVES THROUGH OPPOSITE ELLIPTIC INCISIONS

BALL'S TECHNIC

Description.—Two laterally placed cutaneosubcutaneous elliptic flaps, hinging on the median line, with non-connecting ends, are raised, severing the

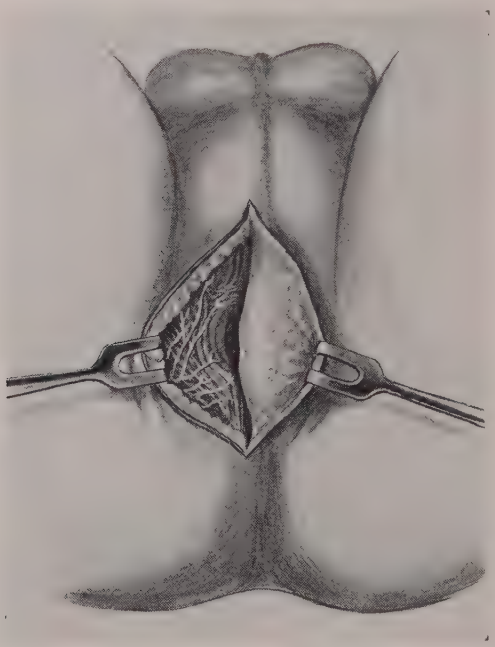


Fig. 4166.—Ball's Operation for Pruritus Ani; – Two semielliptic flaps of skin and connective tissue, surrounding the anus and extending to the sphincter muscle, are raised – and the surrounding margins outwardly, and the two pedicles at the two ends of the incision, are all undercut – thus completely severing the sensory nerve supply to the parts. But one flap is here shown.



Fig. 4167.—The Same – II; – The sutured wound. The undermining of the anterior and posterior bridges is shown in shading.

sensory nerves – and are then replaced, and sutured. The incisions through which the flaps are raised cross, in the main, the direction of the blood-supply of the parts.

Operation.—Two elliptic incisions are made (in the lithotomy position, under analgesia), one on each side of the anus _ from 1.2 to 2.4 cm. ($\frac{1}{2}$—$\frac{3}{4}$ inch) from the anus _ each incision beginning near, but not at, the anterior raphé, and ending near, but not at, the posterior raphé (about 2.4 cm.—$\frac{3}{4}$ inch) of uncut skin tissue intervening between the anterior and posterior ends of the incision _ passing through the skin into the connective tissue. The flaps are then raised toward the anus, being bluntly dissected in the subcutaneous plane by blunt-pointed scissors (Fig. 4166). This blunt dissection is extended inward from the incisions to the mucocutaneous junction within the anal orifice, or somewhat beyond it _ and exposing the external sphincters _ and outward, from the incisions, for about 2.5 cm. (1 inch) outside of the incisions. The dissection in the connective-tissue plane is also continued under the skin bridges anteriorly and posteriorly. In this way all the sensory nerves of the parts are divided. Bleeding is arrested by pressure and by ligature of visible bleeders with fine catgut. Finally, the flaps are dropped back into place and sutured (Fig. 4167). The wound may be sealed with gauze and collodion. A rectal tube is introduced to conduct away feces and flatus. The patient should be kept in bed for a week or ten days. The bowels should be caused to act about the fourth day, by which time primary union should have taken place.

OPERATION FOR PRURITUS ANI BY CUTANEOSUBCUTANEOUS INCISIONS RADIATING FROM THE ANUS

KRAUSE'S TECHNIC

Description.—This procedure has been suggested by Louis J. Krause, of Cincinnati, for the purpose of securing the benefit of the operation originally



Fig. 4168.—Operation for Pruritus Ani by Incisions Radiating from the Anus.

carried out by Ball (v. p. 115), without, at the same time, jeopardizing the vitality of the flaps by severing the main blood-supply of the part through

elliptic incisions laterally placed. This is accomplished by incisions radiating from the anus in the manner to be described.

Operation.—The operation is performed under analgesia. From six to eight straight incisions are made _ beginning just outside of the most peripheral limit of irritation, and proceeding, as radii, to the anal orifice, _ passing through the skin into the subcutaneous connective tissue (Fig. 4168). Each flap, between two adjacent radiating incisions, is then undercut, in the connective-tissue plane _ thus separating each flap from the subcutaneous tissue and dividing all the sensory nerves _ but not severing the anal and peripheral attachment of each segmental flap. Sometimes, when difficulties are experienced, each alternate flap can be completely severed at its anal aspect and turned outward. After all bleeding has been stopped by pressure or by ligature with fine catgut the flaps are sutured back into position along each line of previous section.

OPERATIVE REPAIR OF LACERATIONS OF THE RECTUM

As these conditions are most frequently encountered in conjunction with childbearing, their repair will be described under the general considerations of the lacerations of the perineum (v. Index, Vol. VI).

TREATMENT OF STRICTURE OF THE ANORECTUM AND RECTUM BY DILATATION

Classification of Strictures.—Congenital _ inflammatory _ catarrhal _ tubercular _ dysenteric _ syphilitic _ gonorrheal _ ulcerative _ neoplastic (intramural) _ neoplastic (extramural) _ hypertrophy of Houstonian valves _

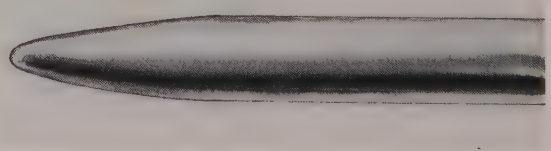


Fig. 4169.—Conical Rectal Bougie of Rubber.

spasmodic _ traumatic (from operation) _ traumatic (from injury). Stricture of the rectum may occur in any part of its course, but usually within 9 cm. (3½ inches) of its lower end. Stricture of the anal orifice frequently follows extensive or non-technical operations for hemorrhoids.

Indications for Treatment by Dilatation.—The method of dilatation is often only palliative, but may prove curative. Its especial field of usefulness is in strictures which are of recent formation _ limited in extent _ situated low in the rectum _ and not complicated by adjacent involvements. A stricture submitted to dilatation should be non-friable, as ruptures, with awkward results, have occurred in this connection.

Operation by Gradual Dilatation.—Graduated dilatation by means of the successive use of the fingers to the thumb may be carried out _ and is always safer than instrumental dilatation _ especially in the initial stages. Dilatation by instruments of conical forms, of various sizes (and, exceptionally, by means of distending blades), however, is the usual method of procedure. A conical rectal rubber bougie is seen in Fig. 4169 _ and a conical metallic rectal dilater, in Fig. 4170. In Fig. 4171 is seen a series of graduated, olive-shaped dilators, so shaped as to be self-retaining. A trivalve is seen in Fig. 4119.

Treatment of stricture by graded dilatation, even carefully and gradually carried out, always involves some danger – and rapid dilatation, under anesthesia, is rarely warrantable. This method of treating strictures is es-

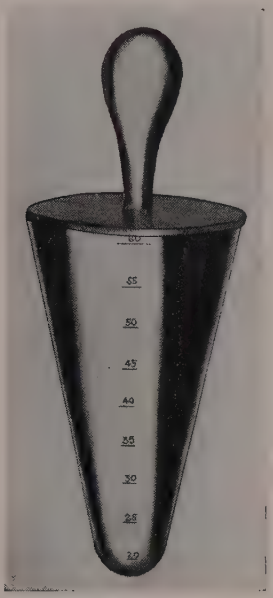


Fig. 4170.—Kelly's Graduated Conical Rectal Dilator. (Redrawn from Earle.)

pecially applicable to those situated below the peritoneal reflection within about 12.7 cm. (5 inches) of the anus.

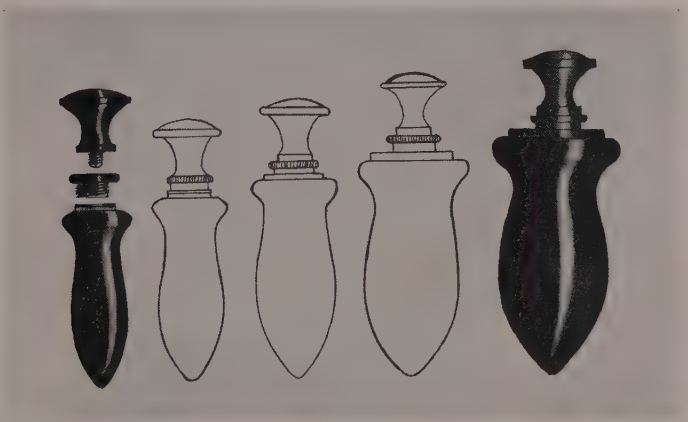


Fig. 4171.—Pratt's Self-retaining, Hollow Rectal Dilators – $\frac{3}{4}$, $\frac{7}{8}$, 1, $1\frac{3}{16}$ and $1\frac{3}{4}$ inches in diameter.

The safest and best method of practising instrumental dilatation of ano rectal and rectal strictures is by means of the Wales graduated, soft-rubber pliable bougies. The instrument is introduced every day, or every second day by the Surgeon at first, and, subsequently, by the patient – and allowed to

remain within the grasp of the stricture for from five to thirty minutes. The technic is suggested in Fig. 4172.



Fig. 4172.—Dilatation of a Rectal Stricture by Means of Wales' Graduated Rubber Dilator.

Stricture of the anal orifice is best treated by means of the self-retaining, volie-shaped dilators shown in Fig. 4171, already quoted.

In the case of stricture situated high up in the rectum – beyond the reach of the finger (Fig. 4173) – the site of stricture should be exposed through a



Fig. 4173.—Multiple Rectal Strictures.

proctoscope or sigmoidoscope – and the bougie introduced through the instrument, into the site of stricture, leaving the bougie *in situ* for a time, after

withdrawing the sigmoidoscope _ using the greatest care _ for peritonitis has been thus caused, even where rupture has not taken place. In many instances the patient should be kept in bed during courses of dilatation _ especially until some headway has been made in stretching the stricture.

OPERATION FOR STRICTURE OF THE ANUS

DIEFFENBACH'S TECHNIC

Description.—Stricture of the anus is usually the result of some previous operative interference _ or of extensive ulceration. The condition can usually



Fig. 4174.—DIEFFENBACH'S PROCTOPLASTY FOR STRICTURE OF THE ANUS _ I; _ Vertical perineal incisions above and below the anus _ prolonged into Y-shaped and inverted Y-shaped extensions outlining flaps.

be treated by periodic instrumental dilatation _ (see Stricture of the Rectum, p. 118).

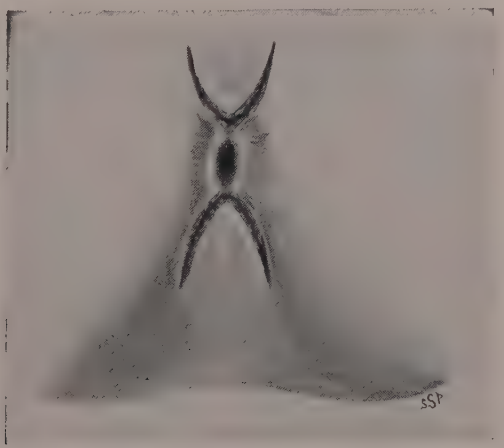


Fig. 4175.—The Same _ II; _ The flaps have been mobilized and the anorectum dilated.

Where much cicatricial tissue is present, some form of plastic operation may be necessary _ such as that about to be described.

Operation.—Straight, longitudinal incisions are made, anteriorly and posteriorly, through the contracted tissue, into and through the margins of the strictured anus (Fig. 4174). From the ends of these two primary incisions, which are furthest from the anus, four secondary incisions are made, in pairs, radiating laterally and obliquely _ passing through skin and connective tissue, and forming two flaps, each representing one-half of an ellipse, and having blunt points (Fig. 4175). These flaps are now dissected up _ and their apices are brought toward each other, until the points of the flaps reach the inner or anal extremities of the primary straight incisions _ after which the flaps and adjacent margins are sutured together (Fig. 4176).

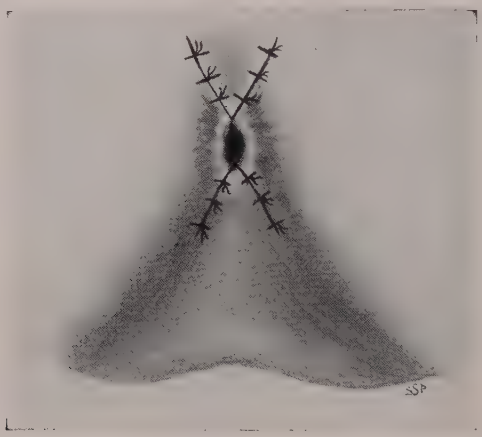


Fig. 4176.—The Same _ III; _ Suturing of the skin flaps to the rectal mucosa _ following the mobilization of the flaps.

It will thus be seen that each freshly made incision is Y-shaped _ and that, when sutured, it becomes V-shaped.

SUPERFICIAL INTERNAL PROCTOTOMY FOR STRICTURE OF THE RECTUM BY MULTIPLE LINEAR INCISIONS

Description.—In this method, which is limited to strictures low down in the rectum, or at the anal orifice, the stricture is incised from within the bowel by multiple, superficial, axial, linear cuts, following dilatation of the sphincter, under anesthesia _ and as a preliminary to systematic dilatation of the strictured site. The case is usually not bettered by simple incision, without following dilatation _ indeed, often made worse. The method is employed for strictures of the annular or tubular type within finger reach (below the reflection of peritoneum).

Operation.—After dilating the sphincter under anesthesia, and with the patient in the lithotomy position, a probe-pointed bistoury, guarded by the left forefinger, is carried up the rectum _ and a superficial, longitudinal incision is made through the stricture, from its upper to its lower limits, but not through the entire rectal wall, upon its posterior and lateral aspects, and sometimes anteriorly as well. An expanding dilator is then introduced, and the strictured site dilated to the desired extent. The distending dilator is then withdrawn and a soft-rubber rectal bougie (about No. 10 of the Wales' type) is introduced _ and this is allowed to remain *in situ* for about thirty-six or forty-eight hours _ the central canal of the bougie allowing intestinal gas to pass.

If any visible bleeding vessels are encountered, before introducing the bougie, these should be ligated. The pressure of the bougie tends to arrest any subsequent tendency to bleed _ but if it do not suffice to this end, gauze may be additionally packed around the bougie. If bleeding were troublesome, one might employ an inflatable bag, such as the Barnes rubber dilators for the uterine canal, in pregnancy, and distend this with air or water.

Subsequently systematic dilatation is maintained.

COMPLETE INTERNAL PROCTOTOMY FOR STRICTURE OF THE RECTUM BY SINGLE POSTERIOR THROUGH-AND-THROUGH INCISION

Description.—This procedure consists of a posterior median incision, made from within the rectum, and extending from the upper limit of the stricture, down through the stricture, anus, sphincters, and perineal tissues in the median line between the anus and coccyx _ dividing all tissues, down to the sacrum and coccyx. The method is used in the treatment of the longer type of annular or tubular strictures of the rectum, extending from the anus upward, not further than 12.7 cm. (5 inches) _ and is limited, by some, to cases where the stricture cannot be excised.

Operation.—Under anesthesia, and after anorectal dilatation, a blunt-pointed bistoury, guided by the left forefinger, is introduced into the rectum and carried up above the upper limit of the stricture _ after which the knife is drawn downward and backward, strictly in the posterior median line, cutting entirely through the wall of the rectum, through all the tissues down to the sacrum and coccyx _ the incision extending through the sphincters and skin of the perineum, back to the tip of the coccyx. The object in making the incision through all the posterior tissues, down to the bone, is to render it impossible for fecal matter and discharges to collect. Immediately following the operation a No. 10 Wales soft-rubber bougie is passed well up the rectum, to see that there are no other strictures _ after which the deep wound is packed with gauze, and a large rubber drainage-tube inserted into the rectum. The tube and packing are retained for from thirty-six to forty-eight hours. After this the wound is irrigated twice daily, and lightly packed, retaining the large drainage-tube. Subsequently continue the twice-daily irrigations, but remove the drainage-tube _ gradually dispensing with the packing _ but daily pass a large size Wales rubber bougie, allowing it to remain *in situ* for about five minutes. Even after the wound has healed the bougie should be passed daily for a year _ to avoid the danger of contraction.

Comment.—There is very little likelihood of incontinence after the operation, as is often supposed. A median incision cuts very few of the circular fibers of the external sphincter, the main portion of the muscle passing backward to the coccyx without decussation, and these fibers are merely separated, and not cut. If a large cicatrix forms between the two separated parts of the external sphincter, some degree of incontinence may result, which, however, is less serious than the condition for which the operation was performed.

The chief dangers in the operation are: hemorrhage, sepsis, and periproctitis.

If any fistulous tracts are present, open them up at the same time.

A curved sharp-pointed bistoury is preferred by some in making the section.

If it be found that the original incision has not divided the entire stricture, the sides of the wound are held apart, and the uncut portion then divided with knife or scissors, under direct vision.

All bleeding vessels encountered in the operation should be tied.

Weir proposed to avoid incising the sphincters, and making the extensive

perineal wound, by making a counteropening for drainage posteriorly _ after having incised through the stricture. The chief objection to this is the possibility of establishing a fistulous tract.

Suturing the granulating surfaces might expedite the healing of the wound and lessen scar tissue, but would interfere with the daily dilatations, which are of paramount importance.

One should pass a bougie into the sigmoid colon before concluding the operation to eliminate the presence of higher strictures.

EXTERNAL PROCTOTOMY FOR STRICTURE OF THE RECTUM BY DORSAL INCISION

Description.—The stricture is here approached from without, through an incision in the back. A less extensive wound, and avoidance of dividing the sphincters, are the chief advantages _ and likelihood of fistula, the chief disadvantage _ of this method of procedure.

Operation.—The patient lies upon his left side, in semiprone posture. The site of stricture is exposed through a posterior skin incision _ and, if necessary, the coccyx and the lower segments of the sacrum are excised (hugging these bones closely, so as to rather separate, *en masse*, the sphincteric attachments, rather than tear them). After exposing the rectum, the strictured portion is divided by an axial incision in the median line. Edwards, in describing this technic, writes, _ "Buried chromic catgut sutures are then passed through the superficial layers of the gut, the wound in the bowel closed longitudinally, and the skin wound closed, with provision for drainage. In this way the cicatricial tissue which forms the stricture is left ununited. A drainage-tube should be inserted through the anal canal, and retained there, to provide for the escape of flatus and discharges."

Comment.—It does not seem apparent how daily dilatation, which is a salient feature of the after-treatment of all strictures operated upon by simple incision, is to be carried on satisfactorily _ and maintain the integrity of the sutured site _ unless it be meant, and even if it be meant, that the "superficial layers of the gut" referred to above mean the perirectal connective tissue and muscular coat.

OPERATION FOR STRICTURE OF THE RECTUM BY EXCISION OF THE STRICTURED PORTION OF THE RECTUM

Description.—Excision of the strictured portion of the rectum is sometimes resorted to in cases where there is no extensive ulceration, no fistulous tracts, and where the stricture is non-specific _ and where other methods of procedure seem less applicable.

Two forms of excision are practised _ the Perineal Method _ and the Sacral Method. These methods are very much the same as those practised in excisions for malignancy.

Excision of the Strictured Portion of the Rectum by the Perineal Method.—This method is applicable in those cases where the stricture is within 6 cm. ($2\frac{3}{8}$ inches) of the anus. The procedure will differ, according to the part of the lower rectum involved: _ (*a*) Excision of the Strictured Lower Rectum by the Perineal Route, when the Anus and Sphincters are involved, _ The anorectum is surrounded by an incision and dissected out up to the higher level of the stricture _ and even mobilized still higher, if there be any chance of bringing the remaining rectum down to the level of the skin. The rectum is then divided above the higher limit of the stricture _ after which effort is made to bring the lower end of the upper segment of remaining rectum down

to the level of the skin, and suture it there — but, failing in this, it is sutured as near to it as possible.

(*b*) Excision of the Strictured Lower Rectum by the Perineal Route, when the Anus and Sphincters are not involved — by a Posterior, Median Incision: — A median, straight incision is carried from the posterior aspect of the anus to the tip of the coccyx — after which the rectum is dissected out, and circularly divided, throughout, immediately above the internal sphincter. Retracting laterally the flaps which contain the medially divided muscles, the rectum is freed, by dissection, to the higher limit of the stricture — and mobilized even beyond, if this can be done without much hemorrhage. The rectum is then severed transversely, just above the stricture — and an effort made to draw the lower end of the remaining segment down to the divided anorectal canal and suture the wall of the upper segment to the undisturbed anorectal canal — suturing the outer coats in one tier of chromic sutures — and the mucosa in another, thus bringing the mucosæ together over the sphincter muscles. The divided sphincter muscles are then sutured together. If the segments cannot be brought into contact, they are sutured as near each other as possible, and the intervening distance left to heal by granulation — a large drainage-tube being introduced to bridge the gap and conduct feces over it, as far as possible. In these cases (where the ends cannot be brought in contact) it is best not to suture together the divided sphincter muscles.

(*c*) Excision of the Strictured Lower Rectum by the Perineal Route, when the Anus and Sphincters are not involved — by a Posterior Elliptic Incision: — An elliptically outlined incision is carried around the posterior two-thirds of the anus, and deepened until above the sphincters. The flap, representing one end of an ellipse, is then dissected and displaced forward, circularly severing the rectum just above the sphincters. The strictured part of the rectum is then dissected out, and circularly divided at its upper limit — after which an effort is made to bring the lower end of the upper segment down to the upper end of the lower segment, and to suture them together and to the sphincters — and the flap and sphincters sutured. If it be impossible to bring about this union, the upper segment of rectum can be brought out, as a temporary artificial anus, to one side of the coccyx — until, later, conditions allow of a second operation, in which the upper segment is further mobilized (through a sacral operation if necessary) and brought down and sutured to the anorectum in the original flap (which has been left loose and lightly packed).

Excision of the Strictured Portion of the Rectum by the Sacral Method.—This method is applicable to those cases in which the stricture lies above a leve of 6 cm. ($2\frac{3}{8}$ inches) from the anus. The technic consists in the application of some modified form of the regular Kraske operation for the excision of the rectum, in malignancy — which is described and pictured elsewhere (v. Index), — or some form of the Rydygier operation (v. Index).

If the stricture is within 9.7 cm. ($3\frac{7}{8}$ inches) of the anus the removal of the coccyx will enable it to be reached.

By whichever of these methods of approach to the site of involvement is obtained, the rectum is seized with forceps and drawn down, while the dissection and mobilization are in progress. If it be necessary the peritoneum can be temporarily opened (to be sutured at the end of the operation) — in which event the peritoneal cavity is not apt to be soiled, for the bowel is not opened until after it has been brought down into the wound, and the peritoneum closed. Finally, the involved site of stricture is excised — and some form of union, or attachment of the remaining upper and lower segments made — either by end-to-end suturing — the Murphy button — or by bringing

the upper fragment through the lower, and suturing it to the skin — after which the wound of approach is closed. Control of hemorrhage, which comes chiefly from the superior hemorrhoidal vessels, is the chief source of concern.

Excision of the Strictured Portion of the Pelvic Colon.—It is accomplished through an abdominal section — after which the remaining ends of the bowel are brought together by some method of end-to-end union. In these high strictures, the parts are sometimes also exposed by the combined intra- and extra-abdominal routes.

SIGMOIDORECTOSTOMY BY LATERAL ENTERO-ANASTOMOSIS, FOR STRICTURE OF THE RECTUM

BACON'S OPERATION

Description.—By means of a Murphy button lateral anastomosis between a loop of sigmoid above, and the rectum below the stricture, the stricture itself is short-circuited from the fecal stream — accomplished partly through

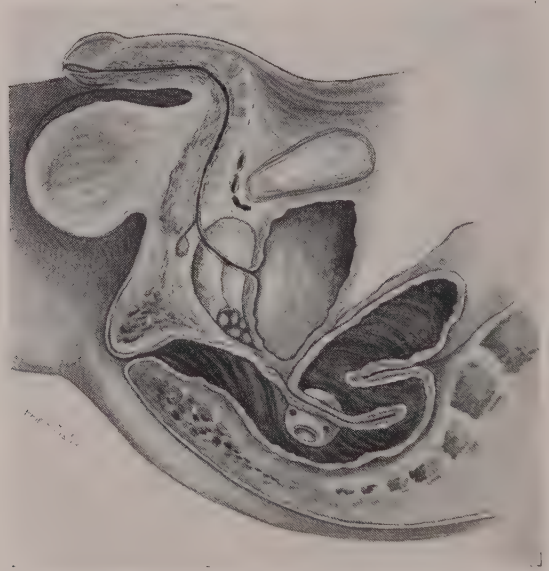


Fig. 4177.—Bacon's Operation for Rectal Stricture by Sigmoidorectostomy — I; — The female half of the Murphy button has been introduced through the anus by a special introductor — and the male half has been introduced through the sigmoid, buttoning the sigmoid down upon the rectum.

abdominal section and partly through the unopened or unexposed rectum. The intestinal spur is subsequently removed by crushing.

Operation.—With the patient in an extreme Trendelenburg position, the sigmoid is exposed by a rather long, median, infra-umbilical abdominal section — and folded down upon the portion of the rectum below the stricture (hinging upon itself), to get the measurement of the sites for placing the halves of the Murphy button. The sigmoid is then delivered outside of the abdominal wound, and clamped on each side of the chosen site, after pressing back the intestinal contents. An axial incision is made in the free aspect of the sigmoid, and the male half of the button secured in the sigmoid. The corresponding sites of the sigmoid and rectum are carefully scraped upon their endothelial surfaces to promote union. The female half of the button is introduced into

the rectum, through the dilated anus, by means of a special button-holding trocar _ and carried up to the site of anastomosis _ and the shank of the button pressed through the anterior wall of the rectum, just below the stricture, carrying the button with it _ after which the two halves of the button are approximated (Fig. 4177). The site of anastomosis is reinforced by several catgut sutures _ which also serve to prevent any coil of small intestine from getting between the anastomosed limbs of large intestine. The button is usually expelled in about a week, leaving an artificial opening in its place. Subsequently, a long-bladed clamp is carried through the anus and up the rectum _ one blade passing through the buttonhole opening into the sigmoid _ and the other blade passing through the site of stricture and into the rectum. The handles of the clamp are then pressed together, reasonably _ compressing the spur (Fig. 4178). On each following day the handles are further compressed



Fig. 4178.—The Same _ II; _ Crushing, with clamp, the septum between the buttonhole opening (nearer the lock of the clamp) and the lumen (nearer the tip of the clamp).

somewhat, until, within three or four days, the spur is cut entirely through _ and the stricture relieved by adding to the caliber of the rectal stricture the caliber of the sigmoid.

OPERATIONS UPON HEMORRHOIDS, IN GENERAL

Description.—Hemorrhoids, or piles, are vascular tumors, situated beneath the mucous membrane of the lower end of the rectum, or mucocutaneous tissue of the anus _ due to varicosed or thrombotic hemorrhoidal veins, or to both. Some degree of infiltration of the surrounding tissues, as well as hypertrophy of the circumanal skin are apt to coexist.

Varieties of Hemorrhoids: _

(*A*) Based Upon Their Position: _

(*a*) External Hemorrhoids _ situated below the external sphincter muscle (Fig. 4180) _ due to dilatation of the inferior hemorrhoidal veins (Fig. 4181, **c**) _ and covered by skin or skin and mucosa.

(*b*) Internal Hemorrhoids _ situated above the external sphincter muscle (Fig. 4180) _ due to dilatation of the superior and middle hemorrhoidal veins (Fig. 4181, **a** and **b**), usually at their junction _ and covered by mucosa only.

(*c*) Mixed or Interno-external Hemorrhoids _ situated partly within and partly without the anorectal canal _ and covered by both mucosa and skin.

A hemorrhoid which originated internally may be ultimately extruded as an external pile.

(*B*) Based Upon Their Pathologic Form: –

(*a*) Varicosed Hemorrhoids – those occurring in dilated and varicosed veins of any of the above varieties.



Fig. 4179.—Hemorrhoidal Structure; – Internal and external piles are shown, covered by mucous membrane. An oval of mucosa, of the superficial rectal wall, has been removed from the central pile. (Modified from Ball.)

(*b*) Thrombotic Hemorrhoids – those occurring in thrombosed veins, of any of the above varieties – usually at the anal margin – and are due either to thrombosis within the vein, or to rupture of the vein and accumulation of blood within the connective tissue.



Fig. 4180.—Sectional View of Internal and External Hemorrhoids.

(*C*) Based Upon Their Causation: –

(*a*) Symptomatic – where they occur secondarily to some primary cause, which must be removed, or bettered, before the hemorrhoid can improve – such as pregnancy, hepatic cirrhosis, and the like.

(*b*) Idiopathic – where they are associated with such conditions as those connected with sedentary living, constipation, and the like.



Fig. 4181.—Veins of the Rectum: – a, Middle hemorrhoidal; – b, middle sacral; – c, interior hemorrhoidal; – d, superior hemorrhoidal. (Modified from Charpy and Poirier.)

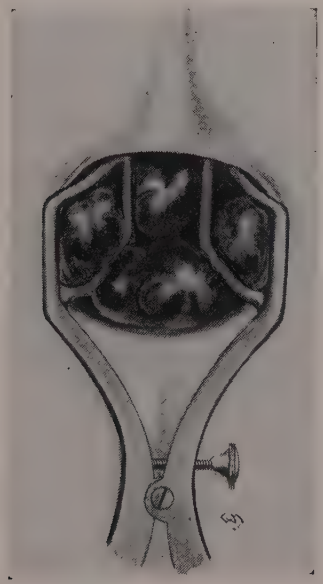


Fig. 4182.—Exposure of Internal Hemorrhoids by Sims' Bivalve Speculum – with the patient in the dorsal position, or on his knees, and with the handle of the speculum upward or downward.

Examination of the Pile-bearing Area.—In advance of undertaking any operation for hemorrhoids – and in advance of putting the patient in position

for such operation – a definite knowledge should be obtained as to the nature of the hemorrhoidal involvement in the particular case. This is accomplished, first, by visual and tactile examination of the external parts, – by digital examination intrarectally, – and by examination of the interior of the anorectal canal visually by means of dilatation of the parts by some form of anorectal speculum. The most satisfactory method, probably, consists in examining the patient while on his back, at the end of the table, with thighs drawn backward – or on his knees, with buttocks to Surgeon – by means of a trivalve or bivalve speculum (Fig 4182). The patient may also lie in Sims' left lateral position, and a univalve speculum be employed (Fig. 4183). Sometimes an internal hemorrhoid may be both located and extruded for operation by means

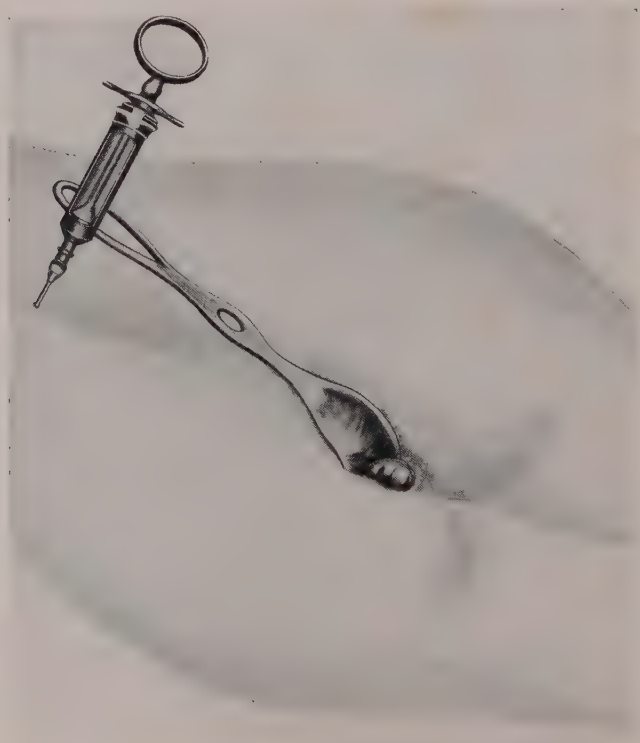


Fig. 4183.—Exposure of Interno-external Hemorrhoids by Hirschman's Univalve Retractor; – Spinal analgesia. Patient in Sims' position.

of the speculum .. as is shown in Fig. 4184 – where Gant's combined examining and operating windowed speculum is engaged in delivering an internal hemorrhoid through the fenestrum left by partially withdrawing the movable blade. Both of the last forms of technic are more applicable where but a single hemorrhoid occupies one wall of the anorectal canal.

Preparation of the Patient.—The intestinal tract should be thoroughly emptied by purgation in advance of operation – so timing the purgation that actions will have ceased several hours before the time set for operation – that the wound may not be soiled and the Surgeon interfered with at the time of operation. The rectum should be irrigated just before the operation. The circumanal region should be shaved if hairs be present. When the patient is

on the table, and after the sphincter is dilated, the rectum is swabbed out by some Surgeons _ and irrigated with such solution as a 1:3000 bichlorid solution, followed by saline, by others. The bladder should be emptied at the time of operation. The skin of the region is cleansed and disinfected.

As mentioned elsewhere, it is well that all patients about to undergo operations upon the oro-esophago-gastro-intestinal tract, and during convalescence therefrom, should, as recommended by Matas, go upon antitetanic diet (which consists in subjecting to a temperature of 212° F. all food which may have come into contact with the soil).

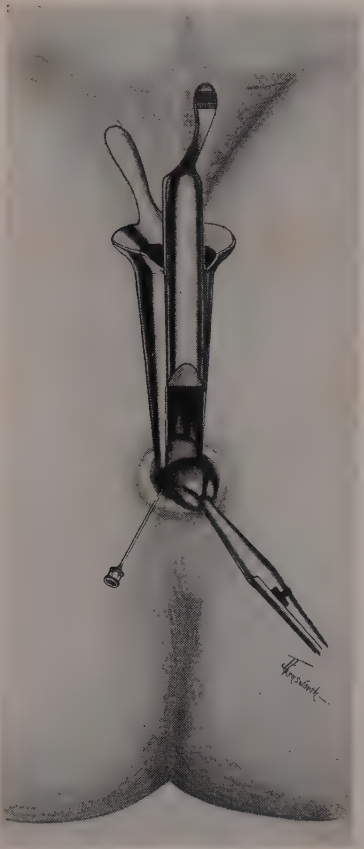


Fig. 4184.—Gant's Technic of Delivering a Moderately High Internal Hemorrhoid by Means of His Rectal Speculum; _ The hemorrhoid is held downward and outward by traction forceps, preparatory to ligation. Analgesizing needle is entering base of hemorrhoid.

Position of the Patient.—This will depend upon the predilection of the individual Surgeon. The dorsal (lithotomy) position is usually chosen _ the patient being at the end of the table, with legs flexed on thighs, and thighs on abdomen, or with the thighs upright and the legs supported by the metal uprights of the operating-table. Some Surgeons prefer Sims' left lateral position.

Anesthesia _ Analgesia.—Analgesia by local injection (novocain-adrenalin solution) is appropriate for minor and intermediate grades of operation _ and anesthesia, for the severer, more prolonged types (such as the

Whitehead). Analgesia by spinal injection is sometimes employed (Fig. 4183). In using analgesia of the immediate site it is convenient to employ a syringe with angulated tip – such as shown in Fig. 4185. In operating under local injection it is important not to inject the hemorrhoid, but especially to inject

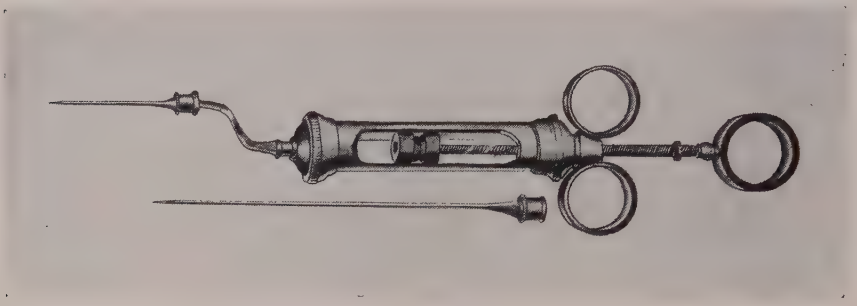


Fig. 4185.—Gant's Goose-neck Analgesia Syringe – for use in the anorectal region.

the periphery of the pile, particularly along its cutaneous margin (Fig. 4186 —in which, however, both forms of injection are used).

Stretching the Sphincter Ani.—In all cases of internal hemorrhoids, and in all in which the pile or piles involve the sphincteric region, the sphincter ani should be dilated after the patient is under anesthesia (only partial dila-

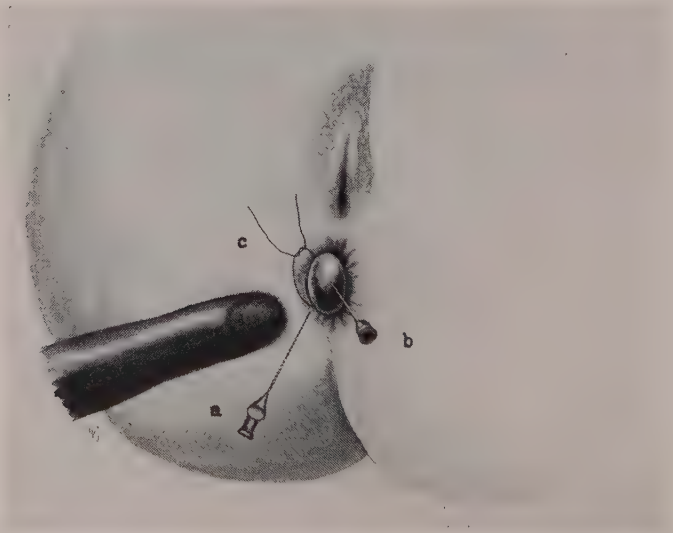


Fig. 4186.—Analgesiation in Operations for Hemorrhoids: – a, Hypodermic needle entering in vicinity of hemorrhoid, and infiltrating adjacent tissue and pedicle; – b, needle entering and analgesizing the substance of the hemorrhoid; – c, ligature about to be tied, following analgesiation, in the previously cut groove through the skin and mucosa of the pedicle. The hemorrhoid may then be excised, as is generally done – or be allowed to drop off beyond the ligature.

tation is accomplishable under analgesia) – until the sphincteric resistance is overcome and the muscle is temporarily paralyzed. This paralysis remains in action for a period following operation, allowing the part to be at rest. While dilatation of the sphincter is sometimes accomplished instrumentally, it is much better, and safer, for the Surgeon to use his two thumbs, or the first

and second fingers of each hand – in the manner shown in Fig. 4187 – first stretching backward and forward, then from side to side, and then reversing. Care is to be exercised that the force be not too great, as the sphincter has been ruptured in the act. After dilatation about 7.5 cm. (3 inches) of the anorectal canal may be readily examined and manipulated.

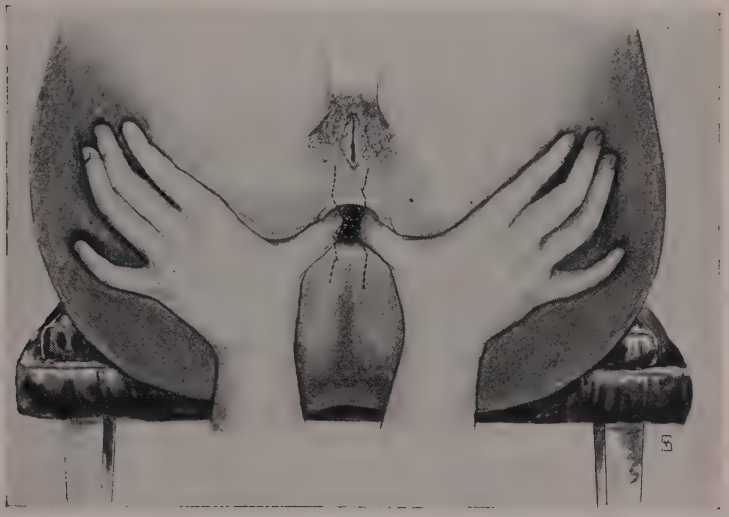


Fig. 4187.—Digital Dilatation of the Anorectal Outlet. – The terminal phalanges of the thumbs, held parallel and semiflexed, are used as lateral dilators – the nates serving as *points d'appui* for the fingers. Dotted lines show the position taken in the dilatation of the anterior and posterior aspects of the outlet.

A special warning is to be noted in connection with anesthesia and the act of stretching the sphincter. Anesthesia should be invariably suspended during the act of stretching, as the stimulus to deep breathing, excited by anorectal dilatation, causes the intaking of an unusual amount of anesthetic. A great many fatalities have occurred during the so considered simple operation for hemorrhoids – probably from the cause just considered, and from the under-

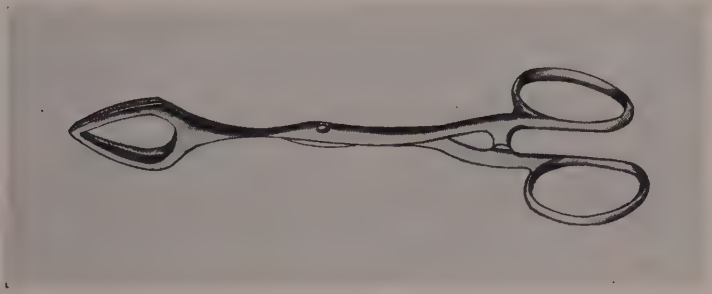


Fig. 4188.—Pointed Hemorrhoidal Forceps. (Redrawn from Fowler.)

rating of the importance of extreme care in technic. The Author has been present at two deaths during operations for hemorrhoids – and at several near deaths.

Some Instruments Commonly Employed in Operating for Hemorrhoids.—Owing to the nature of hemorrhoidal tumors, they are often difficult

to handle during operative technic — so that special forms of hemorrhoidal clamps have been devised, which are of service in the various manipulations. Some of the types commonly employed are shown in Figs. 4188–4191.

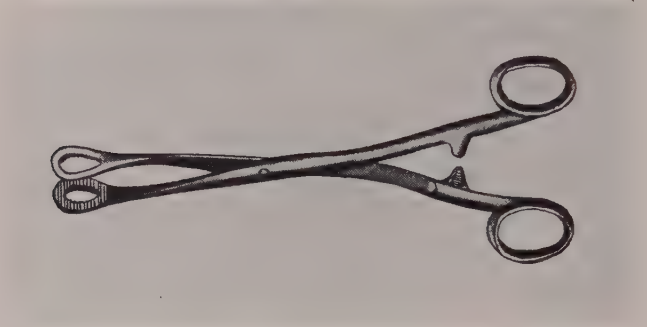


Fig. 4189.—Haywood Smith's Curved Hemorrhoidal Clamp.

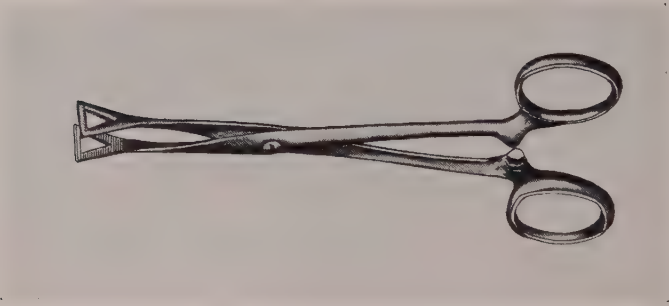


Fig. 4190.—Pennington's Angular Hemorrhoidal Forceps.

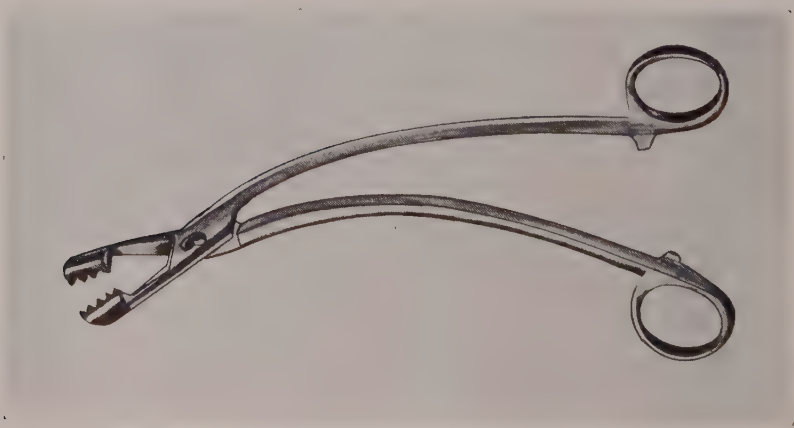


Fig. 4191.—Gant's Hemorrhoidal Forceps. (Redrawn from Gant.)

Where the operation has been at all extensive, and particularly where the case is one of internal hemorrhoids, a special type of drainage-tube is usually employed at the end of the operation — which subserves a twofold purpose — compression of the site from which hemorrhage is apt to occur, and a conduit

for the escape of flatus (as well as fluid feces). A fenestrated rubber tube is surrounded with a few turns of gauze, and an outer layer of rubber tissue, which, at the end of the operation, is inserted into the anorectal canal as shown in Fig. 4192. Bodkin has devised a clever method of treating an ordinary rubber tube so that it becomes an efficient drain and, at the same time, is

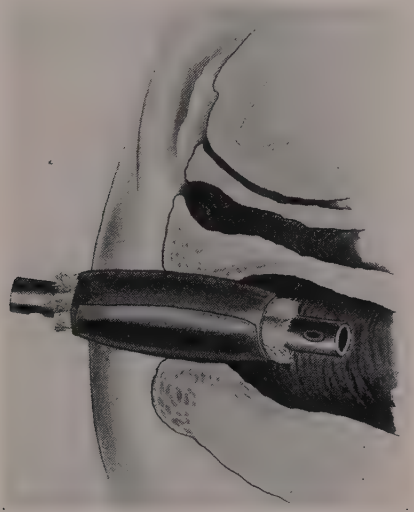


Fig. 4192.—Pennington Tube Within Grasp of the Anorectum for Hemorrhage Control; Perforated rubber tube surrounded with gauze and rubber tissue, which is here represented especially large, as for pressure where bleeding is expected from the site of operation.

self-retentive. The methods of its structure and use are shown in Figs. 4193–4195.

Forms of Operations for Hemorrhoids.—The aim of all operations for piles is the obliteration of the vascular or hemorrhoidal tumor, and this is accomplished by a variety of methods, and by a still larger number of modifications of each main method. The main methods are: incision, ligation,



Fig. 4193.—Bodkin's Modification of Pennington's Rectal Tube, I; Splitting the rubber tube (Modified from Bodkin.)

excision, submucocutaneous excision, these in various conjunctions with or or without suturing, crushing, clamp and cautery, and excision of the entire pile-bearing area, and these in all kinds of combinations, as amply shown in the following descriptions.

Choice of Operation.—This must be reached by the individual Surgeon, and is generally the result of experience and habit, habit, unfortunately, often determining the routine adoption of some method not so good, by un-

biased judgment, as some other method. In the judgment of the Author one of the methods should be invariably chosen which, after removing the hemorrhoidal tumor, and controlling the vessels of the part by ligation, leave the patient with a sutured wound _ *a wound surgically closed.*

One might make the following selection of operative methods: (*a*) For Minor Grades of External or Internal Hemorrhoids, _ Excision and suture; or Excision, ligation, and suture; _ (*b*) For Intermediate Grades of Internal or External Hemorrhoids, _ Submucocutaneous excision, ligation, and suture (preferably, Doyen's submucocutaneous hemorrhoidectomy); _ (*c*) For the Maximum Grade of Mixed Hemorrhoidal Involvement, including Anorectal Relaxation and Prolapse, _ one of the varieties of the Whitehead operation for the circular excision of the entire pile-bearing area of the anorectum, fol-

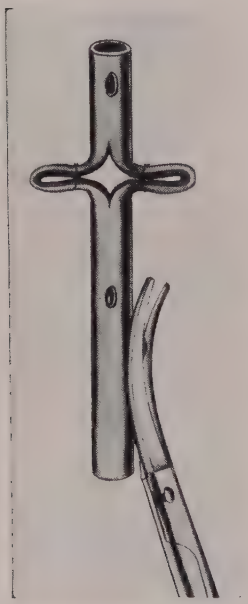


Fig. 4194.—The Same _ II; _ Cutting the drainage-holes and making projections.

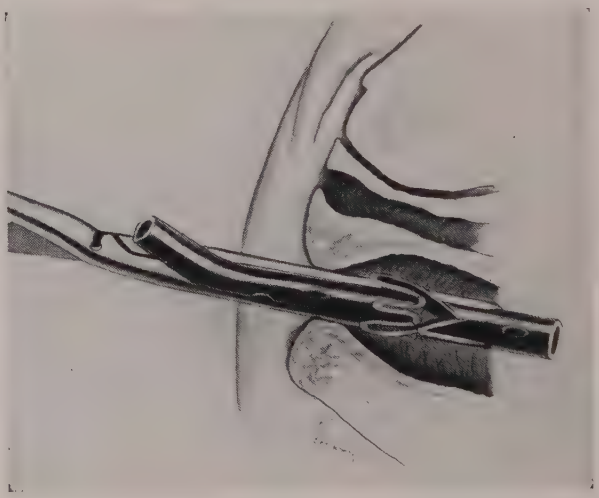


Fig. 4195.—Introduction of Bodkin's Modification of Pennington's Rectal Tube _ III; _ The tube, prepared as previously pictured, is introduced into the rectum grasped by forceps, which partly compress it and the outstanding wings _ the latter regaining their outstretched and, consequently, retentive position upon being released

lowed by the necessary ligation of vascular parts, and the complete closure of the circumferential wound by suture; _ (*d*) For Thrombotic Hemorrhoids, _ Incision, evacuation of clot, and suture _ or the radical removal of the pile by one of the preceding methods.

OPERATION FOR THROMBOSED EXTERNAL HEMORRHOIDS BY INCISION, FOLLOWED BY SUTURING OR BY PACKING

Description.—This type of operation is especially indicated in the thrombosed variety of external pile (thrombosed piles usually occurring at the anal margin) _ in cases where either the thrombus is fresh or has suppurated.

Operation Upon a Freshly Thrombosed Pile by Incision, Followed by Suturing.—This is particularly the category of case in which analgesia suffices _ as the operation is very brief and simple. A curved, sharp-pointed

bistoury is carried through the overlying skin (or mucosa) and vein wall – entering the point of the knife at the inner aspect of the generally firm and sharply contoured pile, and cutting in a straight line radiating outward (Fig. 4196). The blood-clot usually immediately comes to view – and, indeed,



Fig. 4196.—Operation for Thrombotic Hemorrhoid by Incision – I; – Incision through the wall of the pile, to evacuate the clot.

sometimes "pops" out – or may be removed from the vein (or from its connective-tissue bed, if it have ruptured the vein) by means of forceps. No appreciable bleeding ordinarily occurs. The lips of the small wound are immediately sutured with fine catgut – hoping for primary union.



Fig. 4197.—The Same – II: – a, Suturing of the hemorrhoid after evacuation of a fresh clot; – b, packing a hemorrhoidal cavity with a pledget of gauze after evacuating a suppurating thrombus.

Operation Upon a Suppurating Thrombosed Pile by Incision, Followed by Packing.—The first stage of the operation is the same as in the freshly thrombosed variety of pile – except, in the present case, the incision

is more apt to be made through the same overlying parts, but upon a soft or fluctuant tumor, containing pus or a breaking-down pile. Following the evacuation of the fluid, or semisolid contents of the vein, or connective-tissue pocket, the interior of the cavity is best disinfected by pure carbolic acid, followed by alcohol, or by tincture of iodin – after which the cavity is packed with gauze (Fig. 4197, b) – and compression applied – expecting union by granulation.

OPERATION FOR SMALL, ISOLATED HEMORRHOIDS BY SIMPLE LIGATION

Description.—This method is sometimes employed, especially in the case of small, pedunculated, external piles, in timid patients who will not submit to any form of cutting. The ligated pile is strangulated by the ligature, and is allowed to drop off. The method is less desirable than that of ligation, followed by excision.

Operation.—Following analgesiation of the part the pile is seized with a pile clamp and put under slight tension, to expose its pedicle or base – around which a silk or linen ligature is tightly tied – after which the pile is allowed to slough off.

As the chief pain subsequently experienced, following all operations by ligation, comes from the constricting ligature, this will always be very much lessened if, as an invariable routine, an incision is made just through the skin and mucosa in the exact path the ligature will occupy.

The technic of the above operation is shown in Fig. 4186 – already quoted.

Comment.—The method of simple ligation without excision is practised by some Surgeons even in the case of large internal piles – thereby avoiding all possibility of troublesome hemorrhage, which has often followed operations for internal piles. In this connection, F. Swinford Edwards writes, – "The ligatured piles may now be returned into the bowel. They should not be cut off, or at most only their apices; this prevents slipping of the ligatures and grave, troublesome hemorrhage."

OPERATION FOR ISOLATED EXTERNAL HEMORRHOIDS BY SIMPLE EXCISION

Description.—The pile is simply grasped with forceps, excised with scissors or knife, its bleeding vessels, if any, ligated – and its bed left to heal by granulation. At one time this method was applied to piles in general much more often than at present. It is now rarely used – in some cases of long-standing thrombotic hemorrhoids, which may become periodically inflamed, and which have become so adherent and organized that the thrombus is hard to turn out after incision.

Operation.—The analgesiated thrombotic pile or hemorrhoidal tag is seized with clamp forceps and, while held under tension, is cut off by knife or scissors – the knife tending to leave a smaller, more evenly outlined wound. The section should be made in a direction radiating away from the anus – and as little skin should be removed as possible. If any vessels in the bed of the hemorrhoid are found to bleed, these are controlled by twisting or by ligature with fine catgut. A compressing dressing is applied.

OPERATION FOR HEMORRHOIDS BY EXCISION AND SUTURE

MITCHELL'S TECHNIC

Description.—This procedure consists in the clamping of the hemorrhoid, its excision distal to the clamp, and the suturing together of the margins of the cut anorectal tissues over the clamp while still *in situ* – and is applicable

to any case of hemorrhoids where the individual piles are recognizable and are separated by intervening intervals, or sulci.

Operation.—In the case of internal or interno-external piles the anorectal canal is first dilated. The individual pile being dealt with is seized with a

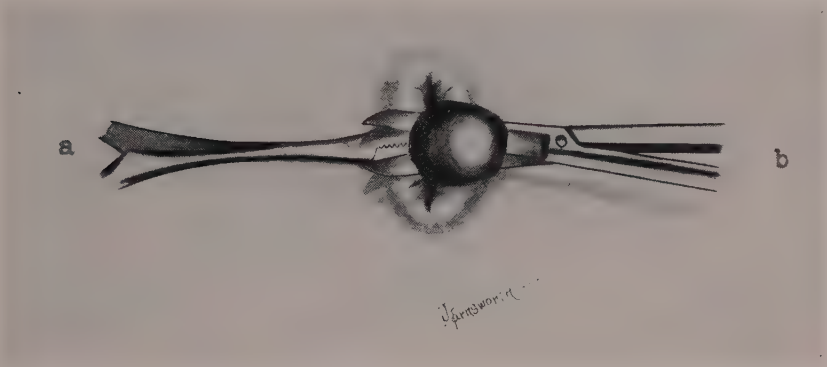


Fig. 4198.—Mitchell's Operation for Hemorrhoids by Excision and Suture.—I: —a, Clamp compressing the base of an interno-external hemorrhoid; —b, scissors dividing the tumor, distal to the grasp of the clamp. The position of the clamp will depend upon the position of the hemorrhoid. Contrary to the picturing, the clamp and scissors should be reversed as to sides.

pile clamp and drawn downward and outward, so as to well expose its base. The pedicle, or base of the pile, is then seized (while the pile is being drawn upon by the clamp) with that form of ordinary hemostatic clamp having rather long blades, and firmly, but not destructively clamped—the axis of



Fig. 4199.—The Same.—II: —a, Stump of hemorrhoid held by clamp forceps; —b, free end of ligature is passed through the tissue just beyond one end of the clamped stump (preferably the one from which the main blood-supply comes, so as to control hemorrhage), after which a curved needle, in holder, carries the other end alternately through the pedicle, under the clamp, and over the raw edge above the clamp, to the end—when the clamp is withdrawn and the continuous suture tightened.

the forceps corresponding with the axis of the anorectal canal (Fig. 4198). The portion of the pile projecting beyond the hemostatic clamp is then excised by scissors or knife. While the clamp is still *in situ* a continuous catgut suture is run through the cut margins, first under, and then over the clamp—

in the fashion in Fig. 4199. The clamp is then relaxed and withdrawn – and the suture carefully tightened and tied, while being molded by the fingers (Fig. 4200). Each pile is taken up in order and similarly treated.

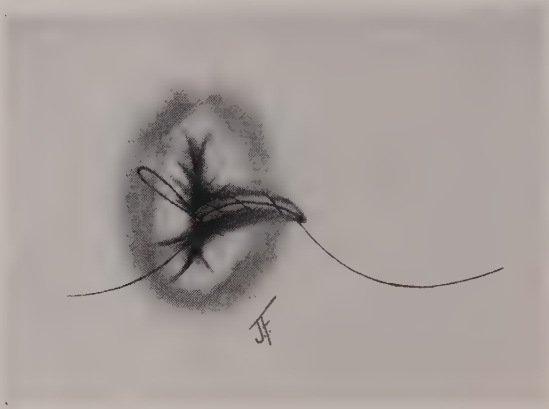


Fig. 4200.—The Same – III; – The suture is tightened while molding the lips of the wound between the thumb and first finger, in such a way as to leave them in accurate contact, rather than puckering and with their free edges protruding – after which the loop and free end of the suture, at the end of the wound last reached, are knotted. The center of each loop could be drawn out, cut, and tied as interrupted sutures.

Comment.—The suture must be carefully placed – for it not only serves to bring the wound margins together, but is the hemostatic agency in the operation. As the blood-supply comes from the proximal end of the sutured line, this should be especially well secured. One may employ interrupted sutures if preferred.

OPERATION FOR HEMORRHOIDS BY EXCISION AND SUTURE

EARLE'S TECHNIC

Description.—This operation is, in every essential respect, as far as isolated hemorrhoids are concerned, exactly the same as Mitchell's operation

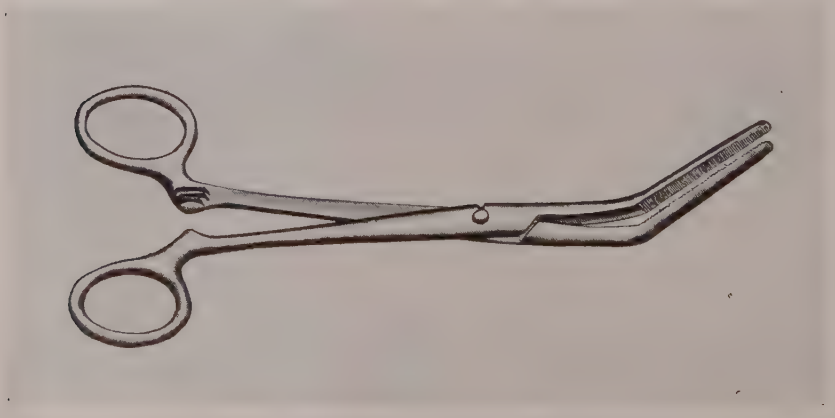


Fig. 4201.—Earle's Hemorrhoidal Clamp. (Redrawn from Gant.)

by excision and suture – except that it is accomplished with the aid of Earle's special clamp forceps (Fig. 4201), and the cutting (excising) and suturing

generally (though not necessarily) proceed *pari passu*. The pile is clamped and is then cut away distally to the clamp, the suturing following each cut of the scissors. The operation is applicable both to isolated piles (one or more, separated by distinct sulci) _ or to cases where the anorectal outlet is surrounded by a diadem of piles.

Operation as Applied to Individual, Separated Piles.—After the patient has been anesthesiated, or the part analgesiated, and the sphincter stretched, each pile, in turn, is seized with a pile clamp and drawn down and its base compressed with Earle's clamp, applied in the long axis of the anorectal canal _ as shown in Fig. 4202 (except that the clamp may not be here lying exactly in the intestinal axis). A running suture of chromic catgut, upon a curved needle (unless, better, a Reverdin needle be used), is then



Fig. 4202.—Earle's Operation for Hemorrhoids by Excision and Suture _ I: _ **a,** Earle's clamp (original type) compressing the base of the drawn-out hemorrhoid (the patient lying in the left lateral Sims' position); _ **b,** scissors severing the base of the hemorrhoid close above the clamped blades; _ **c,** suture which has been passed through a fold of mucous membrane just above the hemorrhoid, so as to control its main blood-supply, and knotted. (The pile is being here removed at one cut of the scissors.)

carried through the fold of mucosa, or mucocutaneous fold, proximal to the clamp, and beginning at one end of the clamp (usually at the proximal end of the blood-supply) and securely tied, for the purpose of controlling the main supply of blood to the part. Then a limited portion of the free part of the pile, distal to the clamp, beginning at one end, is divided with scissors _ after which several passages of the continuous suture are made, passing through the tissues immediately beneath the grasp of the clamp, and over the cut portion of the now free margins of the pile. Then an additional stretch of the clamped pile is cut _ and this portion sutured, in turn _ and so on to the end (Fig. 4203). The clamp is then loosened _ and the lips of the wound are molded into accurate apposition with the left thumb and forefinger, while the fingers of the right hand tighten the suture, and knot it at its end _ the

final appearance of the sutured hemorrhoidal margins being the same as already pictured in Fig. 4200.

Operation as Applied to a Complete Anorectal Hemorrhoidal Diadem.—The method is also applicable to those cases in which the entire cir-

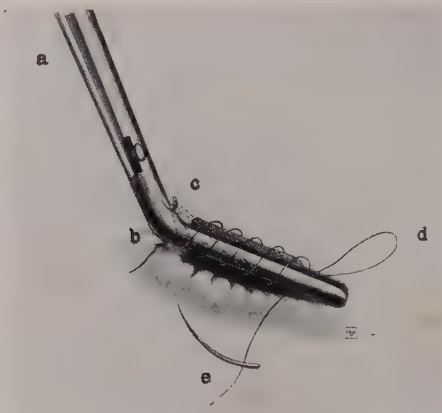


Fig. 4203.—Earle's Operation for Hemorrhoids by Excision and Suture—II: —a, Tuttle's modification of Earle's clamp, compressing the severed base of the hemorrhoid; —Continuous suture (solidly marked thread) knotted at b, as described in the preceding picture, penetrating both folds of the hemorrhoid below the clamp and brought over the free edges of the divided hemorrhoid, above the clamp—repeating the maneuver, as a whipped-over stitch, to the end—after which the clamp is withdrawn through the loops, temporarily held over the catch, c, each of which is then tightened, in order, with forceps—and the loop, d, and free end, e, tied. In using Tuttle's modification of Earle's clamp, here pictured, the suture may be placed over the hook, c, in loops, at each passing of the needle (see the dotted thread), until ready to remove the clamp—thus facilitating the subsequent accurate adjustment of the loops in tightening.

cumference of the anorectal outlet is occupied by a continuous encirclement of piles—and is described and pictured under Earle's Modification of the Whitehead Operation, p. 163.

OPERATION FOR HEMORRHOIDS BY SIMPLE LIGATION AND EXCISION

Description.—In this method, applicable to internal, external, or mixed hemorrhoids, a ligature is simply thrown around the base of the hemorrhoid, or transfixes the base, and is tied, after which the portion of the pile well to the distal side of the ligature is excised. The procedure is especially applicable to cases where the piles are well defined and separated by distinct sulci, and more or less pedunculated—and is probably the most commonly employed method of operating for hemorrhoids—though not as surgical as the technic to be next described.

Operation.—Following analgesiation, or anesthesiation, and, in the case of internal, or mixed hemorrhoids, the stretching of the anorectal canal, each pile, in turn, is grasped with a pile clamp, or other forceps, and drawn downward and away from its wall of origin. At the site chosen for ligation an incision is made through the skin, or mucosa, or skin and mucosa, into the connective-tissue plane (Fig. 4204). The ease with which the pedicle of the pile is exposable will depend upon the position and the nature of the pile. Another important feature in the application of this technic, is the degree of pedunculation which may be present—which may either be marked (as shown in

Fig. 4204), or entirely absent (as shown in Fig. 4207, a), where, indeed, the pile increases in size towards its base. While silk or linen may be preferable,



Fig. 4204.—Operation for Hemorrhoids by Simple Ligation and Excision.—I:—a, Traction forceps drawing the hemorrhoid out of the anorectal opening;—b, knife incising a groove through the mucosa, around the neck of the hemorrhoid.

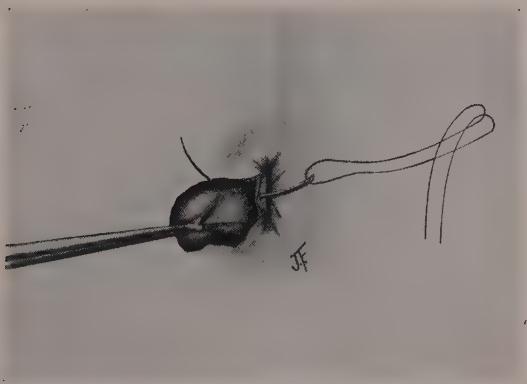


Fig. 4205.—The Same.—II;—A groove has been cut through the mucosa, around the neck of the hemorrhoid—through the center of which a double ligature is being carried by the needle shown transfixing the base of the pile.

from some standpoints, for ligation, chromic catgut (of a size proportionate to the pile) is, as a rule, better—as there is no necessity for its subsequent re-



Fig. 4206.—Ligation Operation Upon a Mixed Interno-external Hemorrhoid by Means of a Reverdin Needle: – a, A Reverdin needle has pierced the base of the hemorrhoid – from the mucous toward the skin aspect, in this case – entering and passing out in the bed of the previously made muco-cutaneous encircling incision. The loop of the ligature is being fed into the opened eye of the needle, which will be withdrawn, bringing the double ligature with it – the limbs of which will then be crossed and tied (as shown in Fig. 4208). To expose the base of the hemorrhoid, it is drawn outward, by the forceps, b – while the anal margin is drawn upon by a retractor – and the opposite finger.

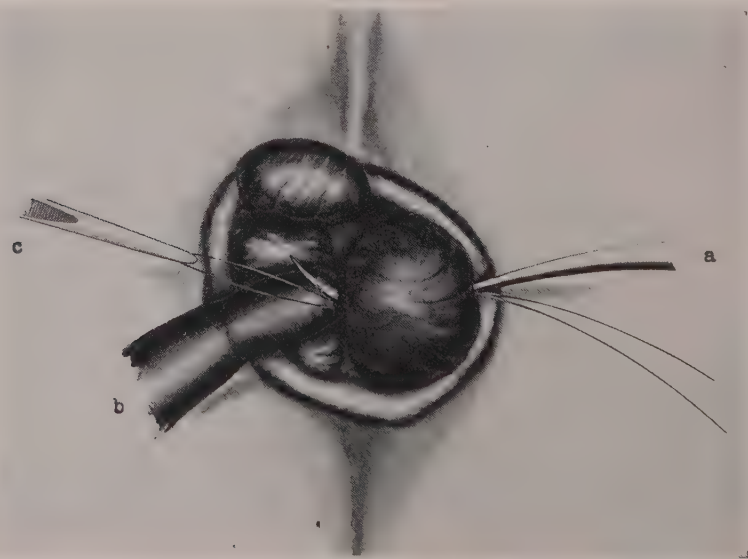


Fig. 4207.—Ligation of Large Internal Hemorrhoids: – a, Threaded Reverdin needle passing through the base of a hemorrhoid, from without and below, inward and above; – b, finger in the lumen of the rectum, guiding the point of the Reverdin at its exit; – c, forceps drawing the loop of the ligature from the eye of the Reverdin, previously to the cutting of the ligature and the crossing of its ends. The base of the hemorrhoid has been transfixed either as just described, or by an ordinary, curved needle, threaded (held in a holder). The anus has been thoroughly dilated.

moval. The ligature is either carried upon a curved needle, held in a holder, or better, is drawn through by a Reverdin needle. In tying smaller, or

markedly pedunculated piles, no needle may be required – the ligature being simply thrown around the base of the pile and tightly tied in the bed of the groove previously made by incision. In all piles of intermediate or large size, however, the needle should transfix the center of the groove cut by knife (Fig. 4205) – drawing a double thread after it. During the passage of the needle a finger steadies the far side of the pile until the needle is about to penetrate this side. In using a Reverdin needle the instrument may be carried through the pile threaded (Fig. 4206) or, generally better, be carried through empty, and then receive the loop of the ligature and draw it back with it. In Fig. 4207, where the pile is of the large, globular type, the former technic is being employed – and it often requires considerable manipulation to carry the ligature up high enough and sufficiently around the site at which it is best to have the ligature constrict the pile – but this can usually be accomplished by marked retraction of the anorectal orifice, externally, and a finger within the rectum and above the pile, internally. Finally, while the pile is held under tension, the two limbs of the ligature are crossed and tightly tied (Fig. 4208). The manner in which the crossed limbs of the ligature control all parts of the



Fig. 4208.—Ligation Operation for Interno-external Hemorrhoids – Crossing the limbs of the ligature; – The two ligatures, drawn through parallel, are crossed, so as to interlock in the center, and are tied on opposite sides.

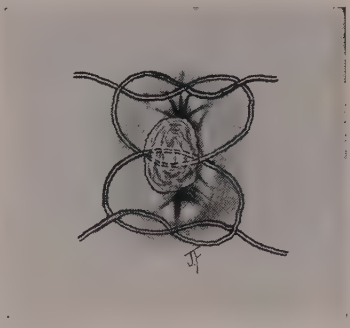


Fig. 4209.—Diagram Illustrating the Crossing of the Ligatures – in the ligation of a pile pedicle by transfixion.

hemorrhoidal structure is shown in Fig. 4209. After the tying of the ligature, the pile, while held by a clamp, is severed between the clamp and the site of ligature – exercising especial care to make sure that the section is made far enough distal to the ligature to insure its retention – for section made very near the ligature is apt to be followed by sufficient loosening and disarrangement of the ligature, in spite of transfixion, as to result in harmful hemorrhage, which, occurring within the concealed rectal cavity, may endanger life. Following excision, the raw stump of the pile is often touched with the actual cautery (Fig. 4210, **d**) or with carbolic acid. In the internal and generally in the mixed forms of hemorrhoids, the ligated stump is withdrawn within the rectal canal. In completing the operation a pile tube is usually introduced and the dressing applied.

In Fig. 4210 the different stages of the technic are illustrated.

Comment.—In performing transfixion, instead of carrying out the technic above described, the pedicle of the pile is often transfixed with a single thread – which is first tied around one-half of the pile pedicle – and is then doubled back upon itself and tied around the opposite half.

In summarizing, it may be said that the above technic is very serviceable in proportion as the pile has a tapering and narrowed base. When the base is

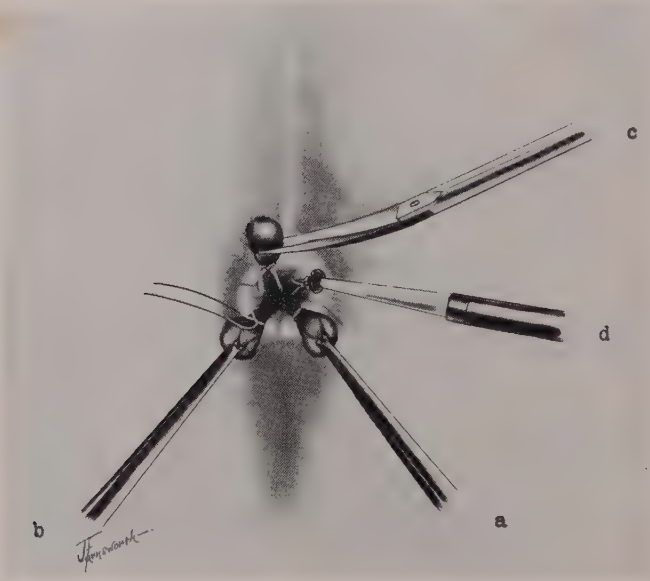


Fig. 4210.—The Stages of the Operation for Hemorrhoids by Ligation and Excision: – a, Hemorrhoid, with mucocutaneous base encircled by incision; – b, ligation applied in the groove of the incision; – c, portion beyond the ligature, removed by scissors; – d, hemorrhoidal stump, touched by the thermocautery.

bulky – and it is sometimes the largest part of the pile – the following more surgical procedure is to be preferred.

PARTIAL SUBMUCOSUBCUTANEOUS LIGATION OF A HEMORRHOID, FOLLOWED BY EXCISION

MATHEW'S TECHNIC

Description.—The base of the pile is surrounded by an encircling ligature, which is partly buried and partly exposed – after which the pile is excised and the ligature tied.

Operation.—The pile is clamped and drawn well outward, and chromic catgut, threaded upon a fully curved needle, is made to encircle the base of the hemorrhoid in such a way that it enters and leaves the mucosa twice – and enters and leaves the skin twice. The needle enters the mucosa, of the inner aspect of the pile, at **a**, Fig. 4211 – passes submucously as well as subcutaneously, to **e**, where it emerges through the skin – after which it runs, in the open, to **f**, where it pierces the skin – and again runs, subcutaneously as well as submucously, to **b**, where it emerges from the mucosa. The ends of the ligature are then drawn upon, while, simultaneously, the clamp practices traction in the opposite direction – while scissors excise the pile safely to the distal side of the encircling ligature. While the Surgeon molds the opposite lips into accurate contact, an Assistant ties the ligature – approximating the skin and mucosa as shown in Fig. 4212.

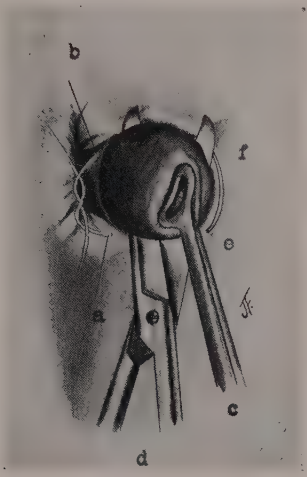


Fig. 4211.—Mathew's Partial Submucosubcutaneous Ligation of a Hemorrhoid, Followed by Excision of the Pile _ I; _ A circular ligature is passed around the base of the pile, by means of a curved needle, passing beneath the skin at a, and under the mucosa at b, and lying exposed between. While the hemorrhoid is drawn forward by traction forceps, c, the pile is severed by knife or scissors, d, just distal to its base.



Fig. 4212.—Mathew's Partial Submucosubcutaneous Ligation of a Hemorrhoid, Followed by Excision of the Pile _ II; _ The circular ligature is tightened and knotted, approximating the mucous and cutaneous aspects of the pile, and controlling hemorrhage.

COMPLETE SUBMUCOSUBCUTANEOUS LIGATION OF A HEMORRHOID WITHOUT EXCISION

RICKETT'S TECHNIC

Description.—The base of the pile is surrounded by an encircling ligature, which is everywhere submucous or subcutaneous, except at its common



Fig. 4213.—Rickett's Complete Submucosubcutaneous Ligation of a Hemorrhoid Without Excision of the Pile _ I; _ The pile having been drawn well inward, a fully curved needle is shown passing around its base, in the connective tissue beneath the skin.

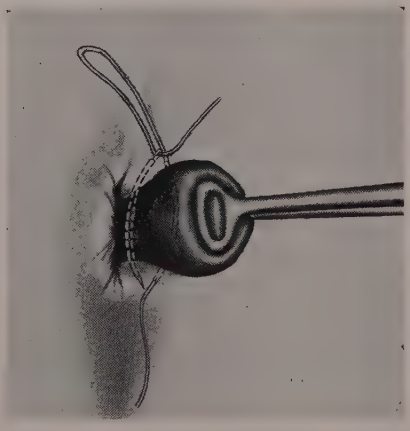


Fig. 4214.—Rickett's Complete Submucosubcutaneous Ligation of a Hemorrhoid Without Excision of the Pile _ II; _ The pile is drawn outward and the sweep of the needle completes the encircling of its base, now beneath the mucous aspect of the pile.

points of entrance and exit. The ends of the ligature are tightened and tied — and the pile allowed to disappear through shrinkage.

Operation.—Medium grade of kangaroo tendon threaded upon a fully curved needle is used. The needle makes two semicircular excursions — encircling one-half of the base of the pile in each passage — re-entering the puncture through which it emerges at the end of its first half-circular excursion — and emerging, finally, through the same opening which it originally entered — always traveling, between these points, in the connective-tissue plane between skin, or mucosa, and pile. When the circuit has been made, the buried, circular ligature is drawn tightly, and tied — the knot being worked in under the skin (or mucosa). The technic is shown in Figs. 4213 and 4214. The constricted pile is simply allowed to contract and shrink *in situ*.

OPERATION FOR ONE OR TWO ISOLATABLE HEMORRHOIDS BY CRUSHING AND EXCISION

Description.—This technic consists in crushing the base of the pile, or of the whole pile, by means of a special pile crusher, or an ordinary angiotribe — followed by the cutting away of the pile through the crushed tract. No

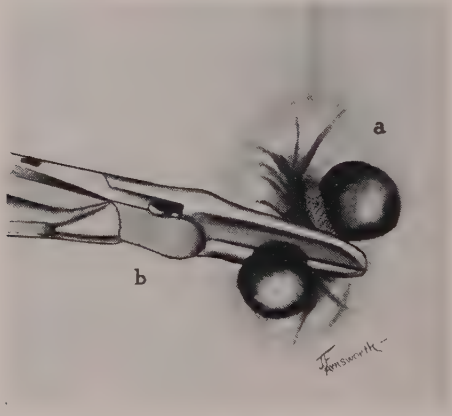


Fig. 4215.—Operation for One or Two Isolatable Hemorrhoids by Crushing and Excision. The individual piles are usually clamped and drawn out, while placing the crusher or angiotribe.

ligature is used. This is one of the older technics, now rarely employed. It is only applicable to cases where a single pile exists, or, at most, two, and these on opposite walls — for where the method is attempted in cases of several nearby piles, the area which has been crushed in dealing with the first pile is apt to be opened up in crushing its immediate neighbor, with consequent hemorrhage — a principle also applicable in the clamp-and-cautery method.

Operation.—The type of crushing instrument devised by Pollock, and modified by Allingham, was arranged somewhat on the guillotine order — except that it crushed, rather than cut. This special type of instrument, however, possesses no essential advantage over the ordinary crushing type of forceps (angiotribe) — of which a broader one may be employed if it be desired to crush the entire pile, or one of an intermediate width, if only the pedicle or base of the pile is to be crushed. Following analgesiation — or anesthesiation — the pile is either drawn through the opening of the technical crusher, or put under tension while the angiotribe is made to grasp its base — after which the instrument is completely closed, and made to compress the

structure continuously for about three minutes (Fig. 4215). The instrument is then removed and the pile divided with scissors through the crushed area – but well along its distal aspect, so that the proximal, uncrushed area may not be opened up.

Comment.—This method is said to be less painful, and healing more rapid, than in the clamp-and-cautery method.

While, technically, it is not a part of the crushing operation, as originally devised, there is no reason why the crushing, as above described, may not be followed by ligation of the pile in the compressed tract – followed by excision of the pile.

OPERATION FOR HEMORRHOIDS BY PRELIMINARY VASCULAR LIGATION, FOLLOWED BY EXCISION AND SUTURE

Description.—The blood-supply of the part is here first controlled by ligature, after which the pile is excised, and the margins of the resulting

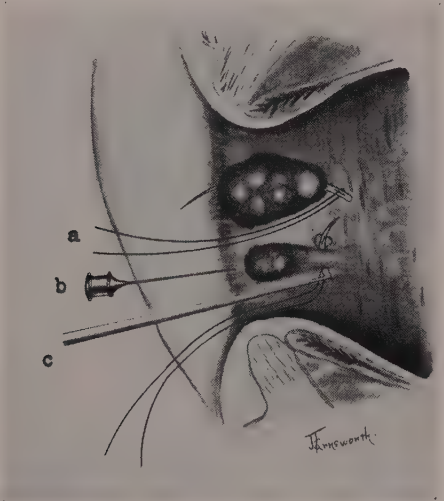


Fig. 4216.—View of the Ligation of Hemorrhoids in Sagittal Section: – a, Transfixion of base of hemorrhoid, from above downward, with double ligature, by needle in holder, followed by crossing of ligatures and ligating the two halves; – b, needle of analgesizing syringe entering the mucosa and passing beneath the hemorrhoid; – c, ligature, in an angulated, eyed needle, being carried beneath the blood-vessels of the hemorrhoid, at the junction of healthy mucosa and hemorrhoid – the ligature is then tied and the hemorrhoid allowed to shrivel into a nodule – or the ligation serves as the preliminary step to excision.

wound sutured. The method is sometimes applicable in well isolated and accessible piles with well-defined pedicles – and has the advantage of closing-in the hemorrhoidal bed by suture rather than leaving it to granulate.

Operation.—The parts are exposed, and the pile seized and drawn down – thus exposing its pedicle. A threaded, right-angled needle is then carried beneath the pedicle, transversely to its course, and brought out on the opposite side and tied (Fig. 4216, c, and Fig. 4217, A), thereby tying off the vessels of the pedicle. If a limited incision be first made through the mucosa, or skin, transversely to the course of the pile, and in the position which the ligature is going to occupy, the element of subsequent discomfort, sometimes following ligation, will be lessened or entirely removed. This transverse cut is seen in Fig. 4217, A. The pile is then drawn away from its bed, by the clamp seizing

its free end, while curved, pointed scissors excise the structure. The lips of the wound from which the pile has been excised are then brought together by sutures of fine catgut (Fig. 4217, C).

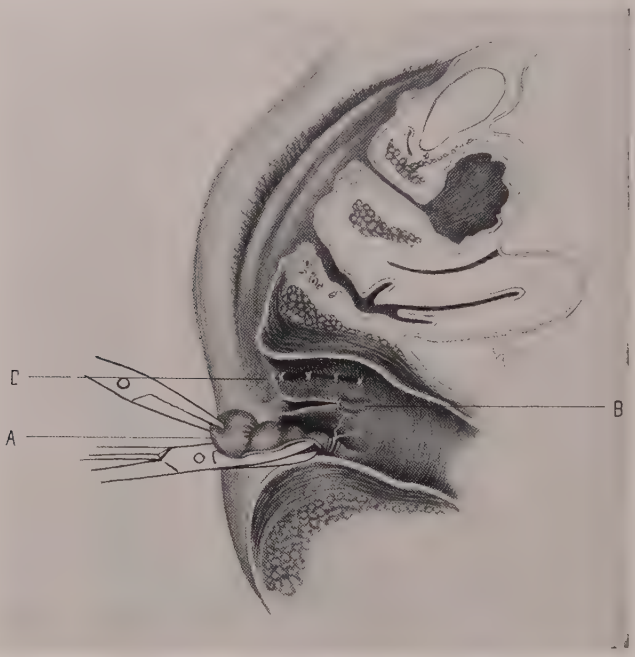


Fig. 4217.—Operation for Hemorrhoids by Preliminary Vascular Ligation, Followed by Excision and Suture: – A, Hemorrhoid excised from its bed and ligature thrown around its pedicle; – B, tract left to granulate after the ordinary operation of removal by ligation and excision; – C, tract, left after ligation and excision, sutured so as to approximate edges and promote primary union.

It may be more convenient to first partially excise the pile and then ligate its pedicle before completing the excision.

HEMORRHOIDECTOMY BY SUBMUCOCUTANEOUS ENUCLEATION, FOLLOWED BY SUTURE—OR REMOVAL OF HEMORRHOIDS BY DISSECTION, LIGATION OF VASCULAR PEDICLE, EXCISION, AND SUTURE

Description.—The hemorrhoidal tumor is exposed through an elliptic incision, paralleling the anorectal orifice, for as much of its extent as is occupied by the tumor – dissected from its bed, up to its vascular pedicle, which is ligated – after which the isolated vascular, hemorrhoidal mass is excised – and the cutaneous and mucous margins of the elliptically shaped wound are closed by suture.

This technic may be regarded as the most surgical of any applied to the cure of hemorrhoids – for it, simultaneously, secures the most radical removal of the hemorrhoidal structures (the vascular tumor), and provides for the complete closure of the wound by suture. It entirely obviates what must always be repugnant to surgical feeling – the leaving of raw surfaces – which characterizes so many of the other forms of operation.

The method is not only applicable to interno-external, external, and internal hemorrhoids but also to single and multiple piles – and the Whitehead operation, employed for the removal of a diadem of hemorrhoids encircling

the anorectal orifice, is but an application of the same principle to the entire anorectal circumference.

Operation.—If the condition be at all extensive, the operation had best be performed under anesthesia, and after thorough relaxation of the parts by stretching the sphincter. An elliptic incision into the connective-tissue plane, over the prominent, presenting part of the hemorrhoidal tumor, is very carefully planned _ the basis of the planning being the restoration of the parts to their normal form. The general curvilinear axis of the elliptic incision will correspond, in a general way, with the curved anorectal orifice. The ends of the ellipse will pass slightly beyond the two limits of the surface aspect of the tumor _ and the width of the ellipse will be calculated to remove just sufficient mucosa, or skin-and-mucosa, so that when the margins of the wound

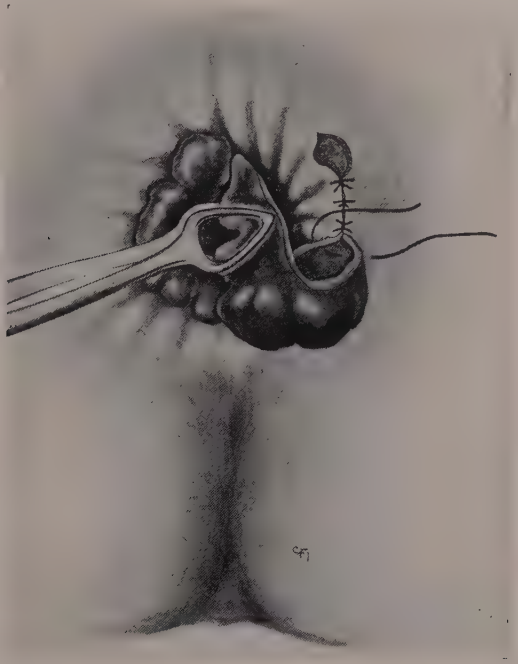


Fig. 4218.—Hemorrhoidectomy by Submucocutaneous Enucleation, Followed by Suture; _ The elliptic incision through skin and mucsoa, paralleling the anorectal margin to the extent occupied by the pile or piles.

are sutured together a normal anorectal outlet will be restored. The surface view of the elliptic incision is shown in Fig. 4218 _ and the sectional view of the amount of mucocutaneous covering to be removed by the ellipse, at its widest part, in Fig. 4219. The portion of the tumor represented by the ellipse is then seized with pointed pile clamps and drawn outward, while, with curved Mayo scissors the inner aspect of the pile is cut away by successive snips in the connective-tissue plane, from the mucosa of the inner side, the scissors hugging the contour of the hemorrhoidal tumor upon its inner aspect, between the tumor and mucosa, until the upper limit or pedicle of the tumor is reached. The tumor is then drawn toward the median line, and its outer contour correspondingly freed by scissor snips in the outer connective-tissue plane until the outer side of the pedicle is reached. This method of dissection

is illustrated in Fig. 4219. When the tumor is everywhere freed up to its pedicle, which is formed by its blood-vessels and connective tissue, a chromic catgut ligature is thrown around the pedicle and tightly tied _ after which the pedicle is divided distally to the ligature _ and the tumor removed. Finally, the margins of the elliptic wound are brought together with interrupted fine chromic catgut sutures _ as seen in Fig. 4219, on the right. In concluding the operation a pile tube is introduced in extensive cases involving the lumen of the bowel, and the dressing applied.

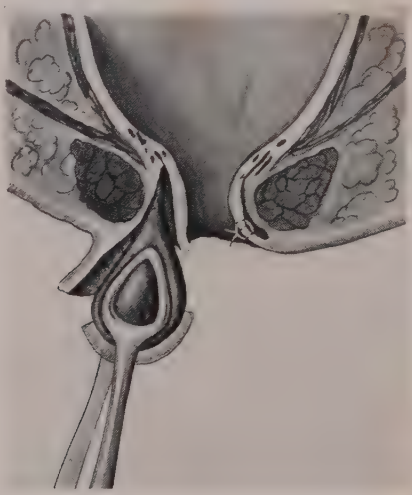


Fig. 4219.—Sectional View of the Submucocutaneous Excision of Hemorrhoids; _ On the patient's right is seen the isolated hemorrhoid grasped by forceps, with the cutaneous and mucous flaps in evidence, and separated from the pile and its pedicle _ while the area of mucocutaneous tissue excised with the pile is seen attached to its surface. On the left the margins of the two flaps are shown sutured together, over the bed formerly occupied by the hemorrhoid.

Comment.—In dealing with isolated hemorrhoidal tumors it might sometimes be the case that the individual tumor could be more satisfactorily dealt with through an elliptic incision made over the pile in its long axis, that is, in the axis of the anorectal canal _ and subsequently sutured in the same axis.

OPERATION FOR HEMORRHOIDS BY PARTIAL DISSECTION AND LIGATION WITH OR WITHOUT EXCISION

SALMON'S OPERATION—GENERALLY KNOWN AS ALLINGHAM'S OPERATION

Description.—This technic was devised by Salmon, nearly seventy-five years ago _ although usually spoken of as Allingham's operation _ and has been extensively employed at St. Mark's Hospital, London, and elsewhere. The technic consists, briefly, of dissecting only the outer aspect of the pile, or piles, from their bed, up to their pedicle, which is then ligated together with the mucosa. The pile may or may not be excised. The raw bed from which it has been partially dissected is not sutured. The operation is readily carried out with isolated piles, and, when applied to aggregated piles, the compound hemorrhoidal tumor may be axially split, and the individual parts dealt with as though separate piles. The operation seems to be well begun _ but, in leaving raw surface (especially in such a foul region), to lack the surgical completeness of submucocutaneous hemorrhoidectomy (p. 150).

Operation.—The patient having been anesthetized, and the anorectal

canal dilated, each pile is seized in turn with a pile clamp, and dealt with in the following manner – or all the piles may be seized by clamps at once, and the piles drawn down, so as to aid in the eversion, and then each one dealt with in turn. It is well to first deal with those piles which are lowest in the field of operation, as the patient may be lying, so that the hemorrhage from a lower source will not obscure the tissues higher up. The clamped pile which is to be first operated upon is drawn downward and toward the opposite margin of the anus, so as to expose and tense the outer (cutaneous) aspect of the pile. With a pair of stout scissors (sharp or blunt, straight or curved – some Surgeons preferring the blunt, curved Mayo scissors, because of their



Fig. 4220.—Operations for Hemorrhoids by Partial Dissection and Ligation With or Without Excision – Salmon's Technic; – The piles have been drawn down – and one is being tracted by the Surgeon's left hand, while, with scissors, he dissects its outer aspect away from the rectal wall, up to its pedicle of vessels and mucosa – hugging, in the act, the contour of the pile, if it be pear-shaped, or, in any event, narrowing the piece of mucosa which is being freed with the pile, by cutting convergingly toward the pedicle, on either side of the tumor. The tumor is then drawn outward, and its pedicle ligated, with or without cutting a bed through the mucosa for the ligature – after which either the tumor is returned into the bowel or the distal part of its substance is excised.

aid, if further blunt dissection be necessary) a single, vigorous cut is made parallel with the axis of the anorectal canal, in the sulcus, or white line indicating the junction of the skin and mucosa. This cut extends up in the connective-tissue plane between the sphincter and the mucosa for a distance of 1.2 to 2.5 cm. ($\frac{1}{2}$–1 inch), according to the nature of the hemorrhoidal tumor, and its size, parallel with the bowel – thus severing the pile from the anorectum, on its outer aspect – but leaving undisturbed its mucous aspect and the pedicle (Fig. 4220). In this way no important vessels are prematurely injured, as the larger vessels course downward from above, parallel with the bowel, and just under the mucosa.

As the inner aspect of the pile will often remain covered by an unnecessary width of mucosa, and as the excessive sacrifice of mucosa often leads to serious constriction of the bowel, it is well to narrow the strip of mucosa attached to each pile by carrying an incision up each side of the pile, through the mucosa, the two incisions approaching each other as the pedicle is neared. The pedicle – which consists of the vessels of the pile, some connective tissue, and the mucosa – is now firmly tied with strong chromic catgut (some preferring to use silk or linen). The knot is tied upon the mucous aspect of the bowel.

Each pile is similarly treated. Any bleeding vessels found in the raw beds are tied with fine catgut, while the individual piles are drawn inward to aid in the finding of bleeding vessels.

The final disposal of the ligated pile will differ, according to the views of the individual Operator. In the original technic, after the ligature was tied, all small or medium piles were left *in situ* – to be ultimately separated by the cutting through of the ligature. In larger piles the outer parts, well distal to the ligature, were excised. F. Swinford Edwards writes – "The ligatured piles may now be returned into the bowel. They should not be cut off, or, at most, only their apices; this prevents slipping of the ligature and grave trouble from hemorrhage." If, therefore, possible hemorrhage be the only reason for leaving the hemorrhoidal masses to undergo retrograde changes within the bowel, if the Surgeon be satisfied with his ligature, it will be logical to do quickly for nature what she must do slowly for herself – and amputate each pile safely distal to its ligature. The raw bed, resulting from the freeing of the pile, is left to granulate.

A pile tube is inserted (which will relieve flatus, and prevent hemorrhage, or, if any occur, at once reveal it) – and the dressing applied. (Its use must be awkward if the pile be left *in situ*.)

Comment.—It would seem to the Author that, by carrying the operation a step or two further, and with but little difficulty after the main part of the work has been done, that much would be added to its technical completeness – and the patient left with a sutured wound. Two suggestions are made, to be applied after the above-described operation has reached the stage of exposure of the pedicle, – first, to transversely incise the mucous portion of the pedicle, down to its vessels, apply a chromic catgut ligature, and excise the tumor safely to the distal side of the ligature, – and, second, to follow this, by suturing, with fine catgut, the margins of the incision, covering the wound, and burying in, in the act, the stump of the ligated pedicle. These additional steps may be surmised in Fig. 4220.

The importance of narrowing the amount of mucosa ultimately removed, especially in extensive involvements, no matter what the technic, is stressed – to avoid subsequent constriction of the anorectal outlet. The outline of the excised mucosa, overlying the tumor, should be bell shaped or pear shaped.

OPERATION FOR HEMORRHOIDS BY PARTIAL DISSECTION, CRUSHING, SPECIAL LIGATION, AND EXCISION

BALL'S TECHNIC

Description.—This method, which is applicable to nearly all cases of internal piles (especially prolapsed internal piles), occurring singly or in combination, is especially characterized by the particular method of freeing the outer aspect of the pile, and (after crushing) by the method of placing and tying the transfixion ligature – resulting after excision of the pile, in the drawing of the mucocutaneous flap down over the crushed and ligated pedicle, thereby largely (though not entirely) burying the site of operation by this

specially planned mucocutaneous flap. Ball uses the method to the practical exclusion of all others.

Operation.—The patient is purged on two consecutive nights, preceding the operation, and the large bowel is well flushed on the morning of the operation. The operation is performed in the lithotomy position, under full anesthesia _ and the sphincters are carefully, but thoroughly stretched, to complete relaxation _ thus fully exposing the anorectal canal for 7.5 cm. (3 inches), for free manipulation. After having examined the parts, to determine how much tissue is to be removed, a pile clamp is applied to each pile which is to be removed (as well as to any relaxed, spongy mucosa which should come



Fig. 4221.—Ball's Operation for Prolapsed Internal Hemorrhoids _ I; _ Isolating a prolapsed pile for ligation _ the line of incision around the base of the pile passing just outside of the pectinate line. (Figs. 4221–4225 modified from Ball.)

away) _ and these clamps retain their hold until each hemorrhoidal tumor held by them has been dealt with _ (for the sake of clearness they are omitted in the pictures here from all piles except the one in the act of being removed). This grasping of all the piles first, insures the omission of none which might be obscured by bleeding. The pile in question is now drawn inward, so as to tense its outer aspect, preparatory to beginning the incision, upon the accurate placing and carrying out of which the technical features of the operation largely depend.

Ball writes _ "As already pointed out, prolapsed internal piles are surrounded by a ring, formed by revolution of the lower zone of the anal canal,

and, between this and the pile proper, there is found an irregular sulcus, which corresponds to the pectinate line, or mucocutaneous junction. If the dissection of the lateral connections of the piles is commenced at the pectinate line, as is commonly recommended, following the original description of Mr. Salmon, it will be found that although the revolution of the lower canal can be reduced at the completion of the operation, it is apt to recur the first time the bowels move, and become permanent in the shape of cutaneous tags (external piles), which give a good deal of annoyance and sometimes require a further operation for their removal. If, on the contrary, the dissection is commenced at the outer edge of this cutaneous ring, too much tissue will be removed, and possibly an anal stricture will result, or, when healing has taken place, it will be found that a portion of mucous membrane has become permanently everted, which is a great discomfort to the patient, from the

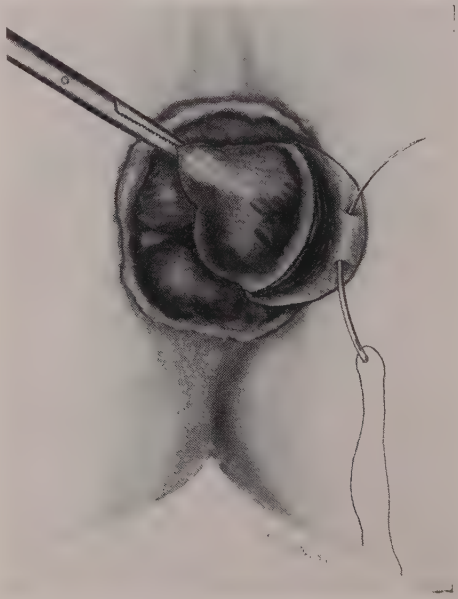


Fig. 4222.—The Same _ II; _ Having passed the ligature, by curved needle, into the cellular surface of the mucocutaneous flap, raised from the external sphincter, the needle is ready to transfix the base of the crushed hemorrhoid.

moist mucous secretion which constantly soils the parts. It is obvious, therefore, that the proper position to commence the dissection is between these two lines."

A curved incision, therefore, is made around the base of the pile, just outside of the pectineal line, and ending in the mucosa at each side of the pile (Fig. 4221) _ carefully avoiding the inclusion of not more than one-third of the cutaneous ring by the greatest convexity of the curve. By careful snips of the scissors the pile is dissected from the external sphincter, which is generally brought into view, and must not be injured. The dissection is continued up the anorectal canal, on the outer side of the pile, until the pedicle of the pile is reached, consisting of only the vessels of the pile and the mucosa. The pedicle is then crushed _ preferably with some form of crushing-clamp having parallel-acting blades and of considerable power.

A curved needle, threaded with stout silk, is carried through the connec-

tive tissue of the mucocutaneous flap, at its greatest convexity, and in the position indicated in Fig. 4222. The needle next transfixes the center of the



Fig. 4223.—The Same _ III; _ Retracting the flap raised from the external sphincter, the ligature is then carried, by the needle, through the center of the crushed base of the pile from without, inward.



Fig. 4224.—The Same _ IV; _ The ligature is first tied around one-half of the crushed base of the pile _ and then around the other half.



Fig. 4225.—The Same _ V; _ The result of the subcutaneous ligature _ drawing the skin flap down upon the site of the ligature.

crushed pedicle of vessels, connective tissue, and mucosa (Fig. 4223) _ after which the single ligature is first tied around one side of the pedicle, and then

the same ligature is brought around and tied over the opposite side (so that one side is doubly tied _ Fig. 4224). This ligature not only controls the vessels of the tumor, but, when the pile is excised distally to the ligature, it brings down the mucocutaneous flap (because of its penetration of the connective tissue of the skin forming the revoluted flap) down upon the pedicle, thus returning the mucous portion of the mucocutaneous flap to its normal position within the anorectal canal, and holding it there until union finally fixes it in position. The pile is now excised at a safe distance distal to the ligature. The free margin of the mucocutaneous flap tied down upon the pedicle is seen in Fig. 4225.

OPERATION FOR EXTENSIVE HEMORRHOIDAL ENCIRCLEMENT OF THE ANORECTUM BY EXCISION OF THE PILE-BEARING AREA, FOLLOWED BY SUTURE

WHITEHEAD'S OPERATION

Description.—This operation, the most extensive of any performed for hemorrhoids, consists in the excision of the pile-bearing area, or segment of the anorectal mucosa, together with its piles _ the portion removed representing a band-like piece, divided vertically in one place, and of varying width (generally about 3.7 cm., or 1½ inch, in marked cases), dependent upon the degree of involvement. At the end of the excision the entire circular margin of the mucosa, above, is sutured to the entire circular margin of the silk, below. The method is especially applicable to the cases of maximum hemorrhoidal involvement, particularly where the entire anorectal circumference is occupied by piles, and, at the same time, the rectal mucosa is relaxed and prolapsed.

The operation is sometimes wrongly classed among the partial excisions of the lower aspect of the rectum _ which, strictly, it is not _ in that no part of the entire thickness of the rectal wall is removed.

The operation must be performed with extreme care in calculating the tissue to be removed. Ultimate constriction of the resulting orifice has been often reported.

The operation, as originated by Whitehead, in 1882, has been modified, in more or less minor ways, by a number of Surgeons _ so that, at the present time, it is more frequently one of the modifications of the operation that is performed, it would seem, rather than the original procedure itself.

Operation.—The technic, as finally elaborated by Whitehead, will be first described, after which some of the modifications will be given.

Whitehead's Finally Elaborated Technic.—The patient is put under full anesthesia, and then, in the lithotomy position, the anorectum is thoroughly dilated, so that complete relaxation and exposure will result. Beginning at the lowest portion of the anorectal circle, and proceeding, *pari passu*, up and around the two sides of the circumference of the bowel, the Surgeon divides the mucosa with scissors, aided by forceps, exactly along the mucocutaneous line, carefully following every irregularity of the skin _ until the section has been made entirely around the circumference of the anorectal opening. Working by rapid dissection along the submucous plane, with the closed end of blunt scissors, which may occasionally be separated, the external sphincter is first exposed, and then the beginning of the internal sphincter and the mucous membrane, with the attached hemorrhoids, separated from their bed of submucous tissue, are drawn down below the skin margin _ all restraining points of connective tissue being divided. The entire pile-bearing area of mucous membrane is thus separated from the underlying submucous connective tissue, upon which it rested, and is bodily drawn downward. The mucous membrane just above the hemorrhoids is now cut transversely, a small extent

at a time _ and the limited part of the mucous membrane thus freed above, is immediately stitched with silk to the corresponding free border of skin below, which has already been divided along the mucocutaneous line of the primary incision. Following this, another area of mucosa is cut free above _ and at once sutured to the skin below _ and thus on around the circle _ until the circumference of the pile-bearing ribbon of mucosa is removed. All bleeding vessels are at once clamped and twisted, as divided _ but are best tied with fine catgut. Whitehead applied an ice-bag to or near the rectum for the first two days _ and gave an aperient on the fourth day _ the patient returning to work on the tenth day.

Tuttle's Modification of Whitehead's Operation.—The basis of this modification is the fact that the blood-vessels, submucous connective tissue, and mucosa can be readily peeled from the muscular wall of the bowel by working from above downward _ after freeing a path from the lower to the upper plane by blunt dissection.

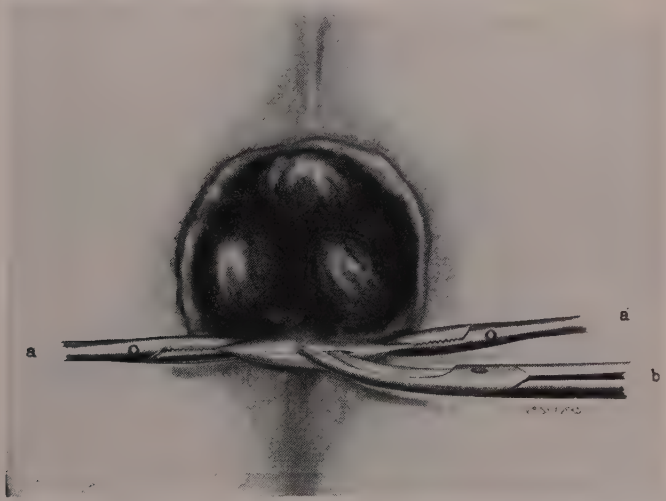


Fig. 4226.—Tuttle's Modified Whitehead Operation, for Marked Degree of Internal Hemorrhoids, with Prolapsed Rectal Mucosa _ I: _ **a, a,** Forceps grasping the mucocutaneous margin of the anal orifice, tensing its border; _ **b,** curved Mayo scissors cutting their way through the tensed border, into the submucous connective-tissue plane.

The preliminaries are as in the original operation. The mucosa, immediately within the mucocutaneous line, is seized with a pair of forceps on each side of the posterior commissure, while, with a pair of curved, blunt-pointed scissors (the Mayo type is excellent) the mucosa just within the mucocutaneous line is incised between the two forceps, or clamps, paralleling the ridged-up border (Fig. 4226). Through the opening thus made the closed, curved, blunt-pointed scissors are inserted, flatwise (concavity upward) _ and, guided by the Surgeon's left index inserted into the bowel, the scissors are made to work their way, by a combined boring and side-to-side movement, by blunt dissection, up as far as the upper margin of the internal sphincter muscle, working between the mucosa and this muscle. Having, by this maneuver, reached the upper limit of this blunt dissection, the scissors, still held flatwise, are simultaneously worked from side to side, and from above downward _ until they come into contact with the mucocutaneous border on each side of the posterior commissure (Fig. 4227), and this process of freeing is continued

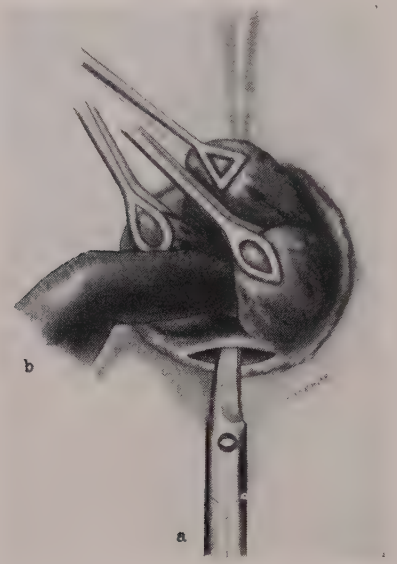


Fig. 4227.—The Same – II: – **a**, Mayo curved scissors working their way, by blunt and sharp dissection, with occasional snips of resisting bands, through the connective-tissue plane, to and beyond the upper limit of the hemorrhoidal involvement; – **b**, finger, introduced into the lumen of the rectum, as a guide to the scissors in their onward progress of freeing the cuff of pile-bearing mucosa, first to the right and then to the left, in its entire circumference, from the upper limit just indicated to, but not through, the mucocutaneous junction.

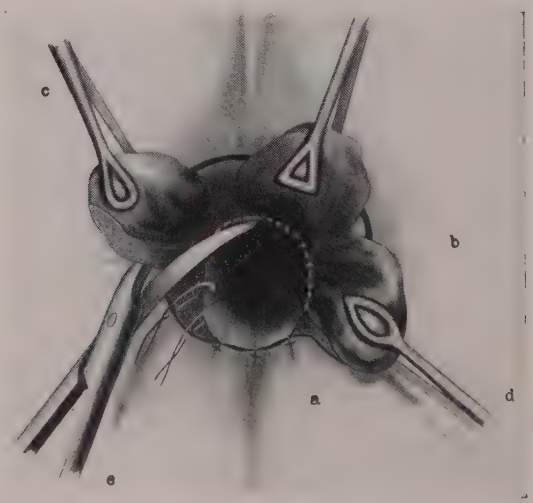


Fig. 4228.—The Same – III; – Following the freeing of the cuff of mucosa from the muscular wall, its lower aspect is divided in its entire circumference, with blunt, curved scissors, just above the mucocutaneous line – so that the pile-bearing segment of mucous membrane hangs, as a cuff, loose within the rectum. A straight incision is then made through the mucosa in the posterior commissure, **a**, to the level of the upper limit of the hemorrhoids, **b**. The two resulting flaps are then grasped with pile clamps, **c**, **d**, and drawn downward, so as to open out the split cuff – while scissors, **e**, cut the mucosa circularly just above the hemorrhoidal region, at a height which previous traction has shown will enable the lower end of the mucosa to reach the skin without too great tension. The lower limit of the divided mucosa above is sutured, step by step, as cut, to the mucocutaneous margin below.

on both sides, until the mucosa and hemorrhoids are freed to the anterior commissure, and evenly, as to axial depth, throughout the entire circumference — being separated from their muscular attachment, and peeled out of their

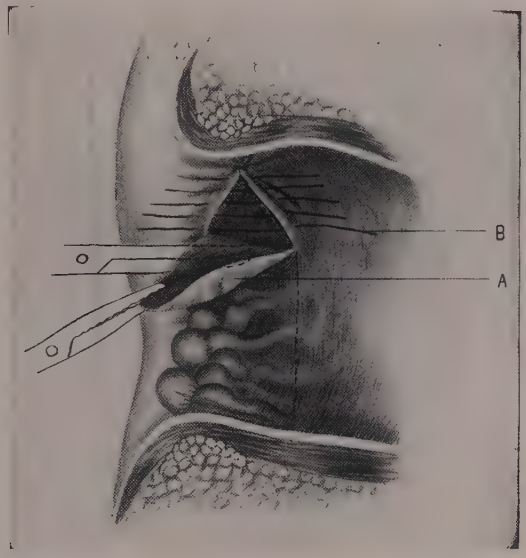


Fig. 4229.—Lateral View of Whitehead's Operation for Hemorrhoids — IV: — A, Pile-bearing segment of mucous membrane being dissected away with scissors, while held upon the stretch with forceps; — B, sutures approximating mucous membrane above to skin below.

muscular bed as an orange is from its skin. The separation is hardest at the anterior commissure. This separated cuff of mucosa is now severed all around its entire circumference, just above the mucocutaneous margin, and thus hangs



Fig. 4230.—The Same — V; — The rectal mucosa has been attached, by interrupted sutures, to the skin, in its entire circumference.

free, except for its upper connection. Next, it is axially divided by a straight cut extending from the marginal aspect of the posterior commissure, up to the upper limit along which it will be eventually divided. Each side of this freed mucohemorrhoidal cuff is seized with a clamp and drawn downward —

while being loosened above by gauze pressure, or blunt dissection – until it is sufficiently mobilized to allow the upper, healthy portion of mucosa to be brought down to the anal margin without tension. The mucosa is then divided transversely with scissors, above the hemorrhoidal mass, step by step, and sutured *pari passu* with the cutting, to the free mucous border below (Fig. 4228). A sectional view of this progress of the operation is seen in Fig. 4229 – (except that in this picture the lower limit of the mucohemorrhoidal cuff is not shown divided in advance of beginning the upper division – both divisions being carried on together). The final appearance of the sutured parts is as shown in Fig. 4230. This method of division and immediate suture usually controls all bleeding – but any actively bleeding vessel encountered should be tied with fine catgut – especially as an extensive postoperative

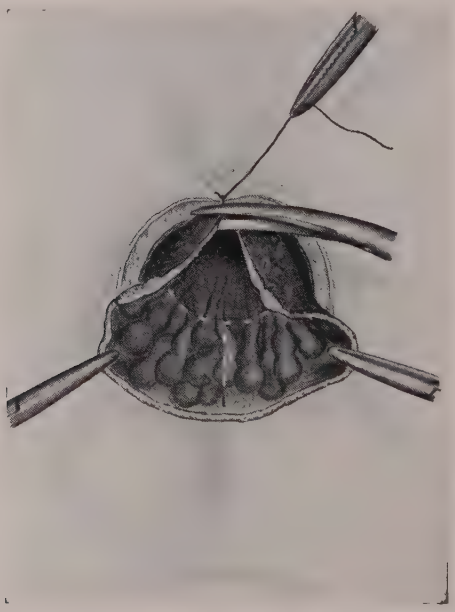


Fig. 4231.—Modification of the Whitehead Operation for Extensive Internal Hemorrhoids by Cuff Dissection *En Masse* – I; – The mucohemorrhoidal cuff is being freed from the muscular wall of the bowel by blunt dissection, all around, and to its uppermost limit – and is then drawn downward. It will be split, axially, along what was formerly its anterior and posterior commissures – each angle of the vertical sections being sutured to the skin before the horizontal section is made.

hematoma in the parts might open up the whole region and prevent primary union. The introduction of a pile-pipe helpfully compresses the mucosa against the rectal wall, diminishing the tendency to hemorrhage. The suturing is done with large-sized catgut – which tears out less readily.

Modification of the Whitehead Operation by Cuff-dissection of the Mucohemorrhoidal Tissues *En Masse*.—The technic of a lower rectal excision is here carried out, in some similarity, except that only mucohemorrhoidal portion of the entire intestinal wall is excised. After entirely completing the marginal circumferential incision of the mucosa, just within the mucocutaneous line, the entire cuff of mucohemorrhoidal tissues is freed by blunt dissection, and drawn down (Fig. 4231). The cuff, thus delivered, is then split, axially, along what was once the anterior and posterior commissures. The upper limits of the anterior and of the posterior splitting of the mucosa is sutured to

the skin (Fig. 4232, b and e). The two half-cuffs of mucohemorrhoidal tissues are then curvilinearly excised on each side, from e to b _ after which the margin of the free mucosa (other than where sutured anteriorly and posteriorly)

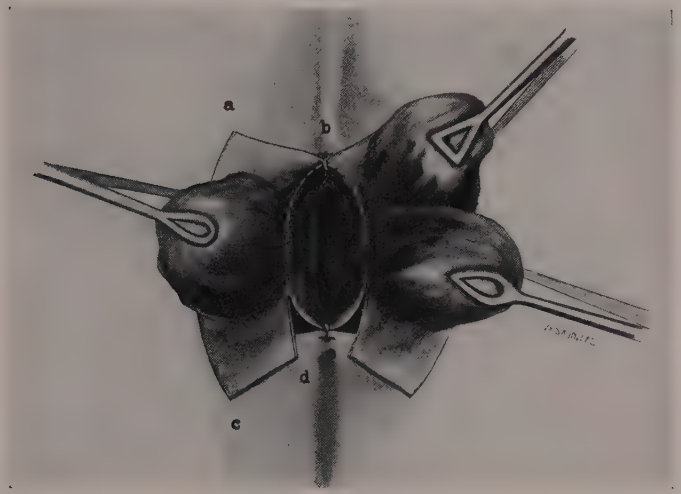


Fig. 4232.—The Same _ II; _ The loosened mucous cuff may be divided in a straight line from its free margin, to above the hemorrhoidal involvement, in both the anterior commissure, a, b, and the posterior commissure, e, d, _ the upper limits of these incisions are then directly stitched to the mucocutaneous borders, anteriorly and posteriorly, by anchoring sutures b and e, _ after which, while the hemorrhoidal masses are held apart, the mucosa is circularly divided above them. The free margins of the normal mucosa thus left are then sutured to the mucocutaneous margin, exactly as in Fig. 4230.

is sutured to the skin margin _ so that, eventually, its appearance is the same as already shown in Fig. 4230. The great danger in this extensive freeing, prior to any method of hemorrhage control, is from hemorrhage _ but if this

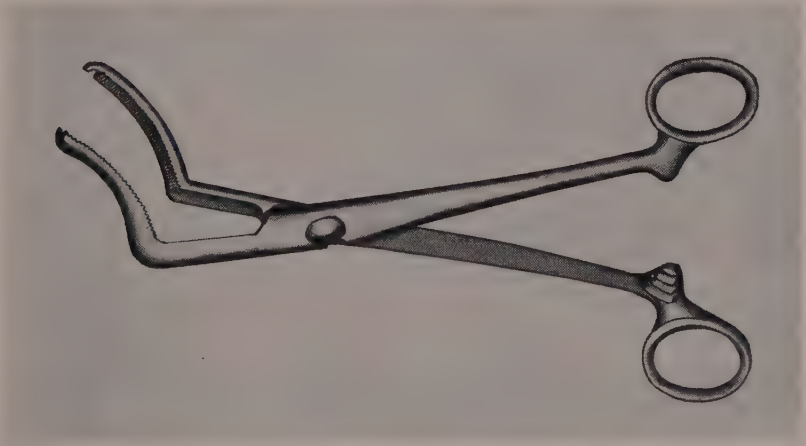


Fig. 4233.—Hebb's Modification of Earle's Hemorrhoidal Forceps. (Redrawn from Earle.)

be successfully combated, the method is probably the speediest of any of the modifications _ not that that is always a warranty.

Earle's Modification of the Whitehead Operation.—The special fea-

ture of this modification is accomplished through the use of a particular type of hemorrhoidal clamp – Earle's special clamp, or, as here shown, Hebb's modification of the Earle hemorrhoidal clamp, or forceps (Fig. 4233). The piles are each seized with a clamp and simultaneously drawn out of the dilated anorectal canal. The posterior commissure is axially divided for a distance sufficient to enable the mucohemorrhoidal tissues to be transversely divided below the external sphincter (Fig. 4234). The first step of the circular suture is then begun at the upper angle of this incision. The special clamp is now applied over successive segments of the circumference of the mucohemorrhoidal mass, which is then excised immediately distal to the clamp, and at once su-

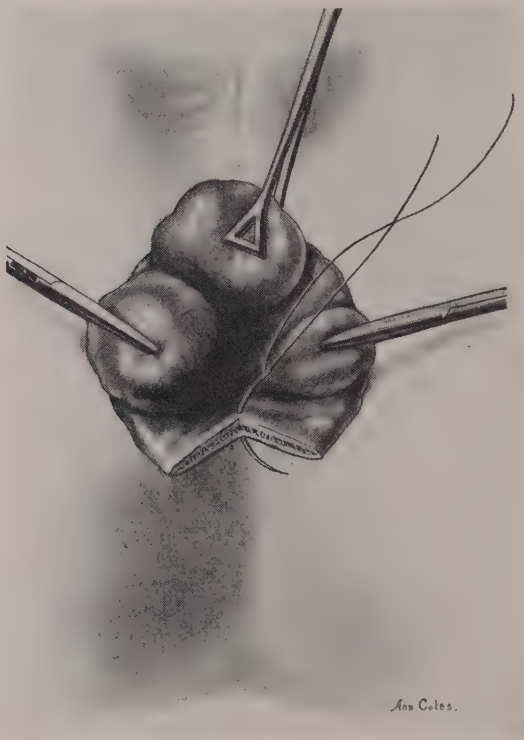


Fig. 4234.—Earle's Modification of the Whitehead Operation – I; – The piles have been clamped and drawn through the stretched anorectal orifice. The posterior commissure has been axially divided (see the text) – and the first suture is being placed and tied in the upper angle of the wound – preparatory to the beginning of the excision.

tured (Fig. 4235) – until the entire circular excision and suturing have been accomplished – the clamp being withdrawn and the suture tightened at each step.

Allingham's Modification of the Whitehead Operation.—A special instrument is used in this technic – which is sufficiently described in the illustration and legend of Fig. 4236.

Comment.—The chief hemorrhage comes from the vessels divided in the transverse division of the mucous membrane and pedicles of the piles above – and this bleeding is largely or entirely controlled by the immediate suturing of the free border of the mucous membrane to the free margin of the skin – but wherever visible vessels bleed, these should be ligated with fine catgut.

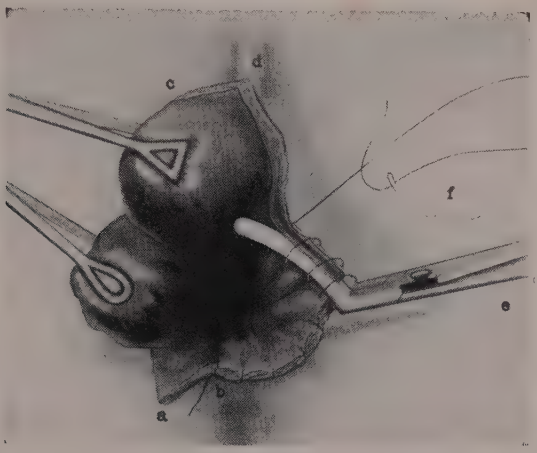


Fig. 4235.—Earle's Modification of Whitehead's Operation for Hemorrhoids by Means of Hebb's Modified Hemorrhoidal Forceps and Scissors; – The previously drawn down pile-bearing segment of mucosa is divided vertically in the posterior commissure, to the upper limit of the hemorrhoidal mass, as the incision here shown, dividing a, b, from c, d; – b beginning of the continuous suture, passing through the mucosa, sphincter, and skin. Beyond the first few turns, Hebb's hemorrhoidal forceps, e, clamps the retracted mass, in successive segments, the outer blade pressing the mucocutaneous aspect, just rectad to the skin margin, and the inner blade, the mucous membrane, just above the hemorrhoids. Hebb's special scissors divide the extra clamped portion close to the clamp, as each new position is taken. A threaded needle, f, carries a continuous suture alternately beneath and over the special clamp – after which the clamp is withdrawn and the suture tightened.

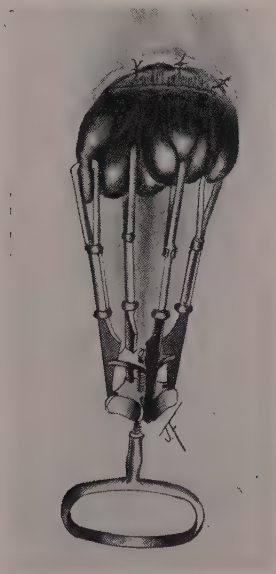


Fig. 4236.—Allingham's Instrument for Whitehead's Hemorrhoidal Operation; – The most prominent hemorrhoids are grasped by the four clamps of the instrument, by means of which they are drawn well downward beyond the anal ring. The mass is then divided circularly at the mucocutaneous line, but only through its outer thickness, and only over a limited segment of the circumference – after which, the divided mucocutaneous line is stitched to the raw aspect of the upper limit of the mucosa, which has been freed in the connective-tissue plane and drawn down. The inner thickness of the mucosa is then divided circularly throughout the entire anorectal circle – and its free edge, after all hemorrhage is controlled, is sutured to the corresponding mucocutaneous border.

The criticisms of the Whitehead operation may be summed up as follows: – the comparative difficulty of the operation (especially in inexperienced hands) – the time consumed – the hemorrhage which is likely to occur during operation, and apt to occur after – the risk of subsequent anorectal stricture (which has often occurred) – and the occasional loss of rectal sense (forewarning of bowel movement and control of flatus). It is, nevertheless, the best operation for the maximum grade of involvement.

OPERATION FOR HEMORRHOIDS BY THE CLAMP AND ACTUAL CAUTERY

Description.—The pile is brought into the grasp of the special hemorrhoidal clamp – excised by scissors (or knife) immediately distal to the clamp – and the stump seared with a red-hot actual cautery (usually of the Paquelin type). The procedure has been applied to any form of pile which could be brought within the grasp of the special clamp – but if the method is to be used, it is best limited to internal piles, as the after discomfort of burns of the skin are unpleasant (as well as unnecessary). Further, the method should be limited to those cases where there are not, at most, but three piles (and, preferably, one or two) – as there is not room to clamp more piles than this number without the danger of the clamp undoing for the subsequent pile what it sought to do for the preceding, namely, pull open the previously constricted pile and detach the hemorrhage-protecting eschar.

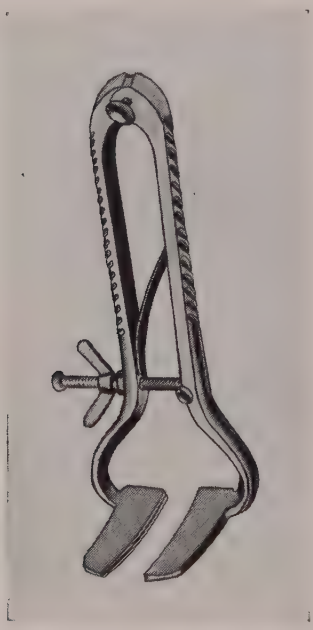


Fig. 4237.—Gant's Hemorrhoidal Clamp. (Redrawn from Gant.)

It is worthy of comment and possible significance that while some Operators frankly state that the method by clamp-and-cautery is their method of choice in dealing with piles in general, that in some of the best works on the subject the clamp-and-cautery method is not only not described, but not even mentioned. It is certainly to be noticed that of a number of Surgeons equally skilled in operative technic, by far the majority will prefer one of the strictly operative technics in the treatment of piles in preference to the cruder technic of pile burning.

Probably more deaths from hemorrhage have followed the clamp-and-cautery operation than have followed any other method. It stands to reason that no site simply protected from bleeding by a simple eschar – even if not subjected to the additionally inviting influences of muscle constriction, flatus expulsion, and fecesflowing – is as safe as one protected by ligature. Briefly, the clamp-and-cautery method of treating hemorrhoids is distinctly less surgical than the strictly operative methods.

Operation.—A hemorrhoidal clamp (Fig. 4237) should be at hand which, upon its removal, releases, last of all, the seared marginal surface of the pile. A Paquelin cautery outfit should be prepared – and tested (Figs. 4238 and 4239). A special pile-holding forceps is desirable.

The patient is, preferably, anesthetized (or the part analgesiated) and the anorectum dilated. The pile is seized with special forceps and drawn outward, exposing its base. Some Operators apply the pile-clamp immediately around the neck of the pile and immediately close it. This should never be done.

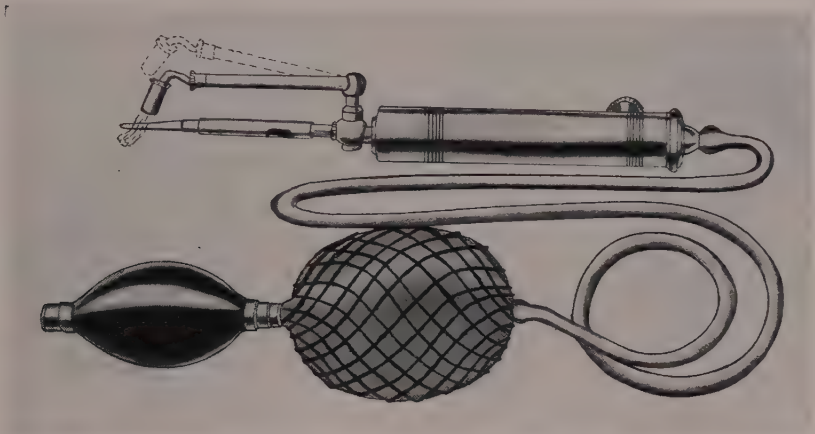


Fig. 4238.—Improved Form of Paquelin Thermocautery – with attached, portable benzine reservoir and movable bellows attachment.

It at least adds somewhat to the surgical aspect of the procedure to invariably encircle the base of each hemorrhoid which is to be treated with an incision, passing through skin, or mucosa into the connective-tissue plane – and the shoulder of the clamp should be received into the groove thus prelim-

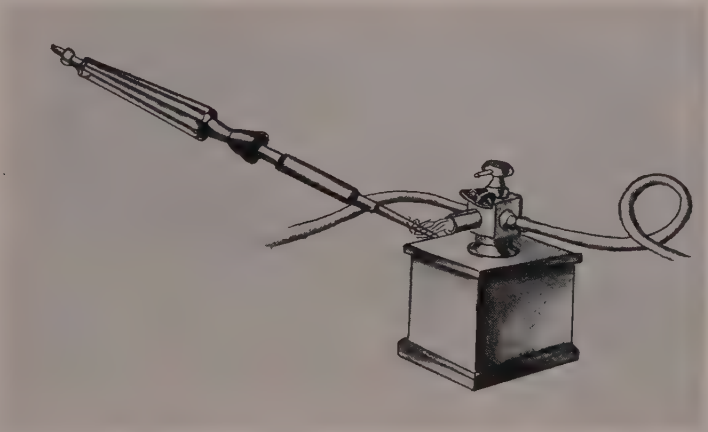


Fig. 4239.—Stationary Benzine Reservoir for Paquelin Cautery with Three-way Cutoff – for C(losing), L(ight), and B(urner). A portable form is made for attachment to the Assistant's coat.

inarily cut. When, finally, the clamp has been tightly closed, the part of the pile projecting above the surface of the clamp is cut off with blunt-pointed scissors curved on the flat (Fig. 4240). The flat surface of the cautery-point at dull red or red heat is then carried back and forth, several times, over the projecting cut margin, until it is burned and smoothed down to the surface

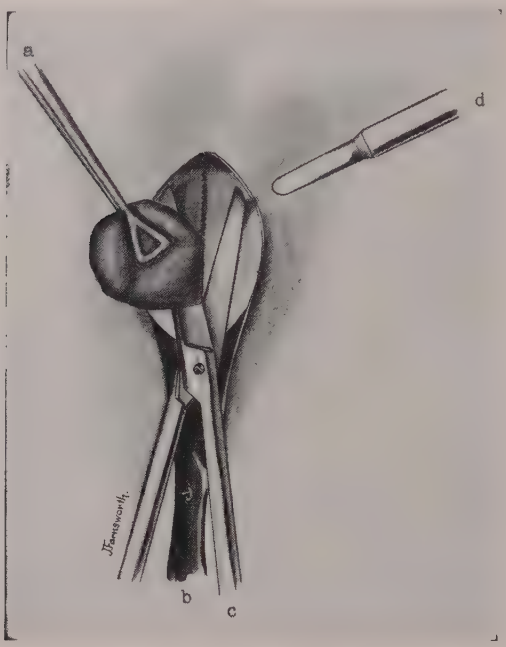


Fig. 4240.—Excision of Hemorrhoids by Means of Clamp and Cautery: – a, Hemorrhoid drawn forward by tissue forceps; – b, Langenbeck's clamp compressing its base; – c, scissors excising pile just distal to clamp; – d, Paquelin thermocautery ready to sear remains of crushed pedicle.

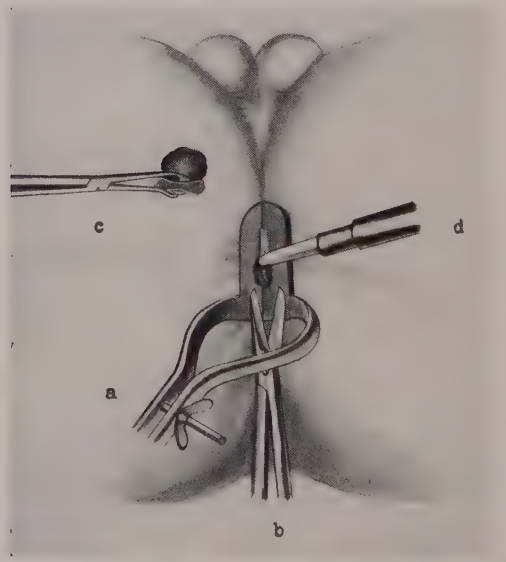


Fig. 4241.—Excision of Hemorrhoids by Right-angled Clamp and Cautery: – a, Gant's clamp, grasping the pedicle of the crushed hemorrhoid; – b, scissors which have just severed the hemorrhoid at its base; – c, forceps, removing the free portion of the hemorrhoid; – d, thermocautery in the act of charring the crushed and divided pedicle.

of the clamp (Fig. 4241) _ after which the clamp is carefully and slowly opened _ and removed _ taking care not to draw apart the compressed and seared margins. This is repeated in the case of the one or of the other two hemorrhoids which are to be submitted to the process. If hemorrhage begins on the slight initial separation of the clamp-blades, these are again brought together, and the cauterization repeated. A pile burned off with red heat is safer than one practically cut off with white heat.

As fatal bleeding has followed this operation a number of times, it is in clamp-and-cautery cases, especially, that the pile-tube should be introduced in concluding the operation _ for the beneficial effects of the pressure it exercises and as a flatus evacuator _ and especially for the knowledge it furnishes of the first escape of blood.

Comment.—The previous surrounding of the part to be clamped, by incision of the mucocutaneous surfaces, into the connective-tissue plane, divides the nerve filaments which would otherwise be included in the clamp.

The pile clamp is applied in the axis of the bowel.

Where a hemorrhoidal tumor is too large for a single compression and burning, it may be split axially, and each half treated as though it were a separate pile.

OPERATIONS FOR PERIANAL AND PERIRECTAL ABSCESSES

Classification of Perianal and Perirectal Abscesses.—Into superficial and deep:

(*A*) **Superficial Peri-ano-rectal Abscesses:** _
- Tegumentary (Fig. 4242, **h**).
- Subcutaneous (Fig. 4242, **g**).
- Submucous (Fig. 4242, **a**).
- Submuco-subcutaneous.
- Ischiorectal (below the levator ani muscle laterally) _ (Fig. 4242, **b**).

(*B*) **Deep Peri-ano-rectal Abscesses:** _
- Pelvirectal (above the levator ani muscle laterally) _ or superior pelvirectal (Fig. 4242, **d**).
- Retrorectal (above the levator ani, posteriorly) _ (Fig. 4243, **a**).
- Interstitial (more or less remote, in the muscular and cellular structures of the buttock).

(*C*) **Mixed Superficial and Deep Peri-ano-rectal Abscesses:** _
- Intercommunicating pelvirectal and ischiorectal (Fig. 4242, **f**).
- Other coexisting combinations (Fig. 4242, **a, b, c**).
- Diffuse perianorectal infective and gangrenous cellulitis.

Peri-ano-rectal abscesses, apart from the damage they may accomplish in the destruction of perineopelvic structures, are generally the forerunners of various types of fistulæ, to be next considered.

The Ischiorectal Fossæ.—The ischiorectal fossa of each side is a triangular and pyramidal area about 5 cm. (2 inches) in depth, lying between the lower rectum and ischial tuberosity _ its base (about 2.5 cm., or 1 inch wide) being represented by the skin of the ischiorectal region _ and its apex being represented by the point of separation of the obturator fascia and the membranous portion given off from it (the ischiorectal or anal fascia) covering the outer aspect of the levator ani muscle. It is deeper posteriorly than anteriorly. It is bounded, Anteriorly, by the line of junction of the superficial perineal fascia, with the base of the triangular ligament; _ Posteriorly, by the border of the gluteus maximus and the great sacro-sciatic ligament; _

Internally, by the sphincter ani, levator ani, and coccygeus muscles; – Externally, by the ischiotuberosity and the obturator fascia covering the inner



Fig. 4242.—Anorectal and Peri-ano-rectal Abscesses in Coronal Section: – **a**, Intramural (submucous) abscess, between rectal mucosa and muscularis; – **b**, large ischiorectal abscess, involving the greater part of the ischiorectal fossa; – **a**, **b**, intramural and ischiorectal abscesses communicating between internal and external sphincters (or the one terminating in the other, at **c**); – **d**, anterolateral superior pelvirectal abscess, above the levator ani; – **e**, ischiorectal abscess in the upper part of the ischiorectal fossa; – **d**, **e**, anterolateral superior pelvirectal and ischiorectal abscesses communicating, by dissection, through the levator ani muscle, or the reverse, at **f**; – **g**, subcutaneous abscess; – **h**, cutaneous abscess. The possible fistulæ from the evacuation of these abscesses are shown in Fig. 4245.

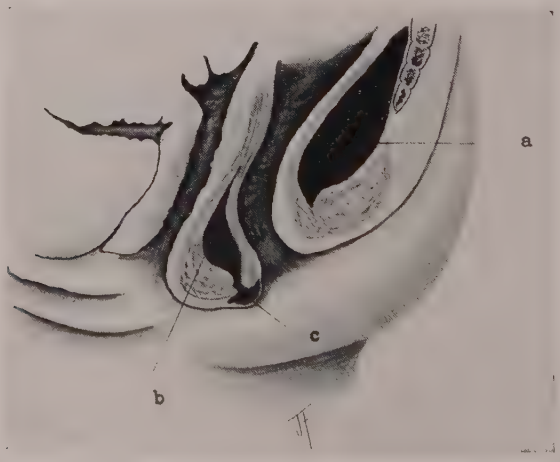


Fig. 4243.—Anorectal and Peri-ano-rectal Abscesses in Sagittal Section: – **a**, Retrorectal abscess, above the levatores ani; – **b**, anorectal abscess, communicating, between the sphincters, with a subcutaneous abscess, **c** (or terminating in the latter).

aspect of the obturator internus. The area is occupied by a large mass of fatty areolar tissue, small vessels, and nerve filaments.

General Principles of Operating Upon Peri-ano-rectal Abscesses.—The salient features in common, practically, to all abscesses of this region are – evacuation, by incision, through the most direct and simplest route – accompanied by the breaking down (usually by the finger) of all barriers between secondary abscesses – and followed by thorough, dependent tubal, or gauze drainage – with or without gauze packing. In simple processes analgesia usually suffices – while in more extensive, or more complicated cases, anesthesia is preferable. In some instances it is well to put the sphincteric apparatus at rest by dilating the anorectal outlet. The best general direction of incisions, for superficial processes, is that they should be in a direction radiating toward the anus, as fewer vessels and nerve filaments are cut (Fig. 4244). In some deeper processes the incision is gradually made

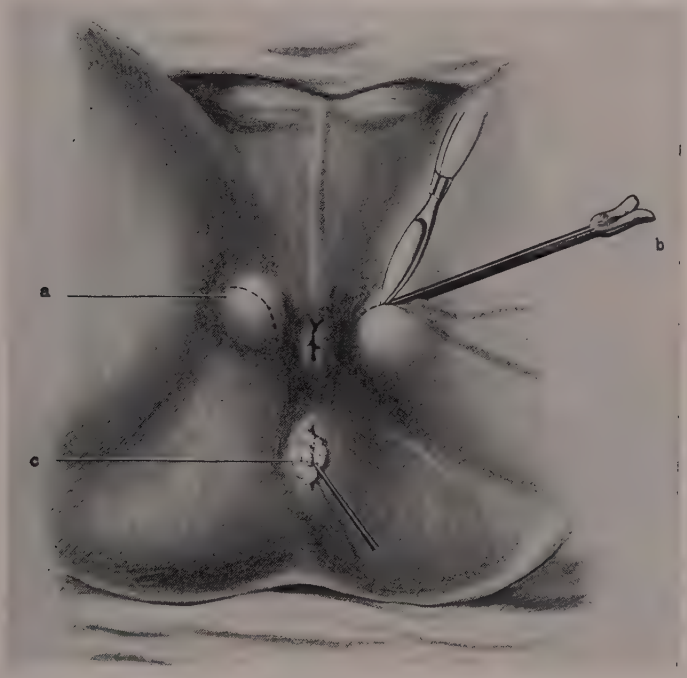


Fig. 4244.—Perirectal Abscesses: – a, Line of incision into abscess, radiating, unless otherwise indicated, toward the anus; – b, an incision having been made, a grooved director is inserted, upon which the abscess is laid open, as far and as deeply as required; – c, an abscess cavity being packed with gauze.

over the base of the ischiorectal fossa, parallel with the median perineal line, and midway between the anus and the ischial tuberosity. The usual method of entering the abscess is by a controlled stab cut, but, better, by deliberate dissection – which may be subsequently extended without, or upon a grooved director. A finger previously introduced into the rectum is a most useful guide. Some of the features belonging to operations upon special forms of abscess will be mentioned.

Operation for Tegumentary and Subcutaneous Abscesses (Fig. 4242, **h** and **g**).—These are the simplest abscesses of this region. They are very superficial – and the incision for their evacuation is very easily made. They usually have their origin in the perianal follicles – whence infection is carried by the lymphatics, or blood-vessels into the dermal or subcutaneous

cellular tissues, or the follicle breaks down into the neighboring tissues. Following incision, it is well to swab out the abscess cavity with pure carbolic acid, followed, or not, by alcohol – or to swab it out with the tincture of iodin – and then pack it with gauze. The knife should not penetrate the opposite wall of the abscess, which nature has erected as a barrier to further spread of the infection.

Operation for Submucous Abscesses.—The principles of involvement and the nature of operative relief is here just the same as in the subcutaneous variety – the chief problem being the exposure of the site in those situated above the anal orifice. Those which are partly subcutaneous and partly submucous may be opened through the cutaneous aspect. Some submucous abscesses, very near the anal margin, may sometimes be "rolled out," until within cutting distance. Where the anorectal orifice is first dilated, care must be exercised that the abscess is not ruptured in the act of stretching the parts. The region is much more fully exposed, naturally, after dilatation – but the site of the abscess may also often be exposed through a windowed speculum, or by a univalve or bivalve retractor. The treatment following incision is the same as that just described for subcutaneous abscess. The sooner incision is made, the less apt is the process to be followed by fistula.

Operation for Ischiorectal Abscesses (Fig. 4242, **a** and **b**).—There may be a unilateral ischiorectal abscess or bilateral ischiorectal abscesses, constituting a complete perirectal abscess – the two abscesses communicating posteriorly, through the space between the aponeurosis of the levator ani and the external sphincter. These abscesses are apt to be honey-combed, requiring the breaking down of the intervening barriers, for thorough drainage. Where large bilateral abscesses coexist, the rectum may be so dissected and undermined from its connective-tissue attachments as to hang suspended in the pelvis, the finger sometimes being able to almost entirely encircle it. Sometimes there is a communication with the rectum posteriorly. All of these bearings point to the earliest possible opening of an ischiorectal abscess. If the process have progressed to a marked extent before being operated upon, unsupported blood-vessels and nerve trunks may be encountered traversing the broken-down, honey-combed area, where, formerly, fatty connective tissue furnished support, and filled all the interstices. The site, therefore, should be incised as soon as infection, manifested by fairly certain signs, is suspected – and prior to the formation of pus – as the most certain way of avoiding extensive destruction.

The incision is made parallel with, but to the outer side of the external sphincter muscle – not by the stab-cut incision – but by deliberate dissection, which must sometimes be carried to the dome of the ischiorectal fossa, a distance of 5 cm. (2 inches), although pus, or, if more fortunate, the indurated focus of infection prior to suppuration, is usually encountered before this depth is traversed. The incision is longest at the skin surface, growing shorter as one ascends the ischiorectal fossa. If the part be merely infected (infective perirectal cellulitis), but not yet broken down, a temporary drain may be introduced, and nothing further done – suturing the excess of skin-wound up to the exit of the drain. If, however, pus be present, as will usually be the case, a finger is introduced, and systematically proceeds to examine the whole region of the abscess, especially seeking for intercommunications, and not desisting until all secondary cavities are broken down into one, and until all necrotic tissue has been separated and removed. The finger may be aided by carrying up a pair of curved dressing-forceps alongside of it. Blunt spoon-curets are sometimes employed – but must be most carefully used – and are inferior to the Surgeon's finger. All honey-combing of the connective

tissue should be broken down with the finger. In many cases of marked disintegration the mechanical steps of separating sloughing tissue and breaking down honey-combing may be greatly aided by simultaneously flushing of the part with some antiseptic solution or plain saline. The Writer has found a uterine irrigator excellent for this purpose. In conclusion, the cavity, unless very large, may be wiped out with carbolic acid, followed by alcohol or with tincture of iodin – after which a large rubber drainage-tube is introduced to the upper end of the cavity or strips of gauze are loosely inserted. A rectal tube is also introduced.

Where both ischiorectal fossæ are involved, one of three courses is open – to incise both abscesses, laterally – to make an especially free opening into one, and drain the opposite one by this route, through the posterior commissure – or to incise in the median line, posteriorly, tapping both cavities from the median incision.

Operation for Pelvirectal Abscesses (Fig. 4242, **d** and **a**).—These, the superior pelvirectal spaces, are the spaces above the levatores ani, on each side, between them and the peritoneum. These, like other abscesses of this region which are capable of doing much damage by extensive dissection, should be incised immediately upon recognition, or even upon strong suspicion. The incision, owing to the depth of the process (above the levator ani) must be free. It is placed parallel with, and well to the outer side of the external sphincter muscle – and is longest on the skin surface, beginning in the posterior part of the anterior quadrant (v. Fig. 4115). For this type of abscess, particularly, is the incision not a stab, often so characteristic of opening abscesses (but never warrantable) – but is a deliberate dissection, carried out with great care, and with foreknowledge of anatomic conditions – for the roof of the ischiorectal fossa is 5 cm. (2 inches) from the skin – and it is not until the partition between this and the superior pelvirectal space, the levator ani muscle, has been cut through, that one begins to enter the site of the abscess – so that one may have to cut through from 6.2 to 7.5 cm. ($2\frac{1}{2}$–3 inches) before being able to reach the site of involvement. (The average index-finger is probably about 7.5 cm., 3 inches long.) As the dissection deepens, one proceeds with additional caution, not to injure adjacent structures. When the cavity is once entered and pus evacuated, the same steps of breaking up all intercommunications, irrigation, and drainage, are the same as in ischiorectal abscesses, just described – of which this is a somewhat similar operation, upon an enlarged scale. The swabbing out of these very high cavities with strong agents is generally omitted.

In proportion as the abscess is situated in the anterior aspect of the pelvirectal space, is the dissection carried up along the recto-urethral plane – guarding the urethra and the anterior peritoneal *culdesac*. The upper parts of such incisions are usually carried on by blunt dissection. The upper regions should be handled most carefully – and not roughly stretched, as one may readily tear these rather friable parts and enter the bladder, rectum, or peritoneum. If the anorectal orifice be not dilated, in operating for both ischiorectal and pelvirectal abscesses, then a stout rubber tube should be invariably left in the rectum, to expedite the expulsion of gas, and minimize all distention of the parts through its accumulation. Curetment of these deep cavities is considered unwise by the majority of Surgeons. No exploratory needles should be employed in these cases. A long, large drainage-tube should be introduced to the bottom (or top) of these cavities, in concluding the operation, through which irrigations may be repeated.

Operation for Retrorectal Abscesses (Fig. 4243, **a**).—This is the space behind the rectum, and between the peritoneal reflection above, the

levatores ani below, and the sacrum and coccyx behind. These abscesses are best opened by a semicircular, or crescentic incision, with upward convexity, placed between the coccyx and the anus, the distance through which the incision must travel before encountering pus being very much shorter than in the deep abscesses of the lateral aspects (the pelvirectal abscesses, just considered). The treatment of the cavity and the question of drainage are here the same as in the other varieties of deep abscess already considered.

Operations Upon Other Forms of Peri-ano-rectal Abscesses.—The various other forms of these abscesses, such as the interstitial, and the mixed, and complicated types, must be met as indicated in each individual case.

ANORECTAL FISTULÆ, IN GENERAL

Description.—Anorectal fistulæ are abnormal channels communicating between either the anus, or rectum, or circumanorectal region, upon the one hand, and the adjacent, or distant surfaces, tissues, or organs, on the other.

Classification of Anorectal Fistulæ.—The following classification, modified from various sources, is arranged upon a fourfold basis: _

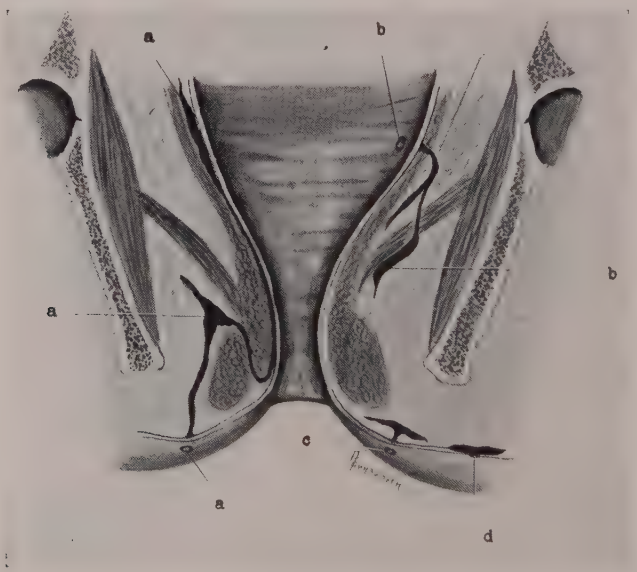


Fig. 4245.—Anorectal and Peri-ano-rectal Fistulæ _ Resulting from the Evacuation of the Abscesses Shown in Fig. 4242: _ **a, a,** Incomplete, blind external submuco-submuscular fistula, resulting from communicating intramural and ischiorectal abscesses; _ **b, b,** incomplete, blind internal, submuscular fistula resulting from communicating superior pelvirectal and ischiorectal abscesses; _ **c,** incomplete blind external subcutaneous fistula, resulting from subcutaneous abscess; _ **d,** incomplete blind external subtegumentary fistula, resulting from subcutaneous abscess.

(*A*) **As to Completeness:** _

(1) Incomplete Fistulæ _ opening upon one surface only: _

Blind External Fistulæ (Fig. 4245, **a, c, d**) _ opening external to the anorectal canal, or region.

Blind Internal Fistulæ (Fig. 4247, **a, b, c**) _ opening within the anorectal canal, or region.

(2) Complete Fistulæ _ exhibiting two openings, one of which is anorectal (Fig. 4248, **a, b, c**).

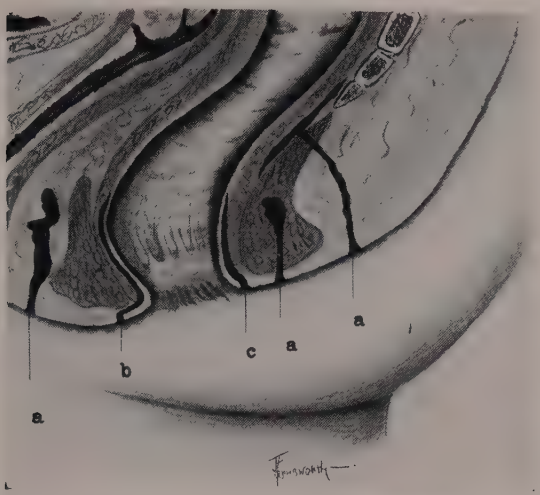


Fig. 4246.—Incomplete, Blind, External Fistulæ: _ a, a, a, Submuscular; _ b, submuco-subcutaneous _ c, submucous.

(*B*) **As to the Nature of Tissues, or Organs Traversed: _**

(1) Subcutaneous (Fig. 4249, **a**).
(2) Submucous (Fig. 4249, **b**).
(3) Submuco-subcutaneous (Fig. 4246, **b**, and Fig. 4248, **c**).
(4) Submuscular, or subaponeurotic (Fig. 4245, **a, a, a**).
(5) Transmuscular, and intermuscular (Fig. 4245, **b** _ and Fig. 4247, **b**).
(6) Rectovesical _ Rectovaginal _ Recto-urethral _ Recto-uterine, etc.

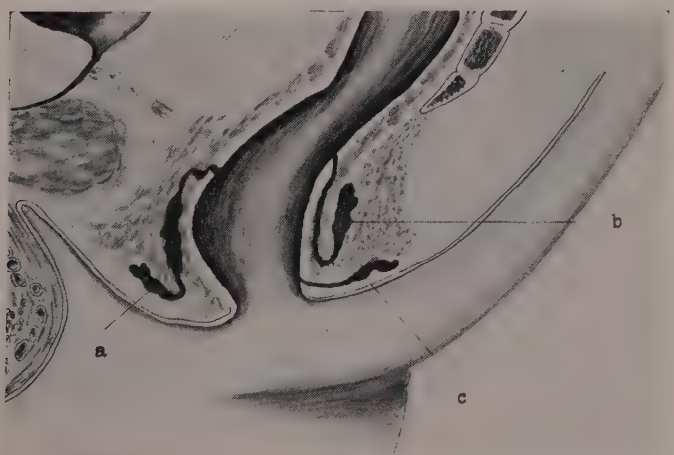


Fig. 4247.—Blind Internal Anorectal Fistulæ: _ a, Fistula passing through the internal sphincter _ between the internal and external, with pockets between the muscles and under the skin; _ b, fistula passing between the mucosa and internal sphincter, and then passing through the internal sphincter, to end between the sphincters; _ c, subcutaneous fistula emptying just within the anus.

(*C*) **As to Their Simplicity, or Complexity of Involvement:**—
(1) Simple (Fig. 4246, **a** and **b**)—passing, by simple and direct route, from origin to end.
(2) Complex (Fig. 4245, **a, a, a**—and Fig. 4250, **a** and **b**)—involving tortuosity of course and complexity of openings.
(3) Complicated—communicating between the anorectal region and other organs.



Fig. 4248.—Complete Submuscular (or Subaponeurotic) and Submuco-cutaneous Fistulæ:—**b**, Complete submuscular fistula, through both sphincters, with pus-pockets between the internal and external sphincters, and between the external sphincter and skin;—**a**, complete submuscular fistula through the internal sphincter and around the external fistula, with a pus-pocket beyond the latter;—**c**, submuco-subcutaneous fistula.

(*D*) **As to Their Cause:**—
(1) Non-specific.
(2) Specific.

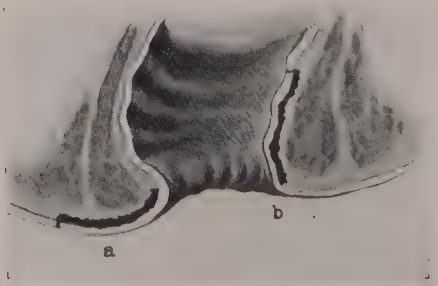


Fig. 4249.—Partially Blind Fistulæ:—**a**, Subcutaneous blind internal anorectal fistula;—**b**, submucous blind external fistula.

Forms and Courses of Anorectal Fistulæ.—The size, shape, and course of anorectal fistulæ vary in all respects—from the exceedingly short and simple—to the exceedingly long, tortuous, and complicated. Their terminal, or intermediate outlets, also vary greatly—in number, size, position, and nature. Surface projections of these great variations are shown in Figs. 4251–4267.

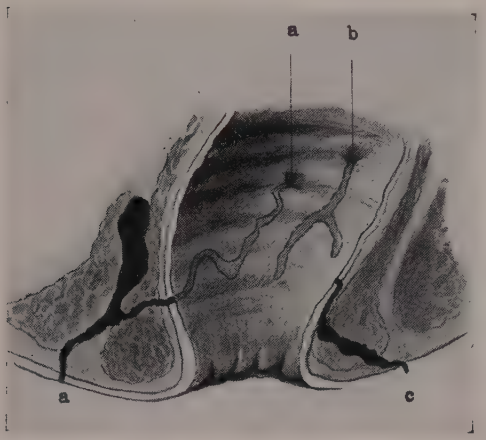
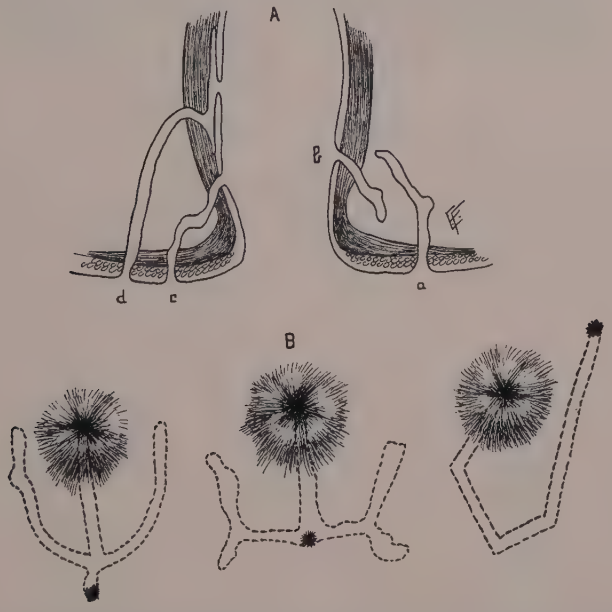


Fig. 4250.—Complex Anorectal Fistulæ: – a, a, Complete fistula, with openings in different quadrants, at different levels; – b, blind Y-shaped internal fistula; – c, complete fistula, traversing the external sphincter muscle.



Figs. 4251–4254.—Forms of Fistulæ in ano: – A, Rectum in vertical section: a, Incomplete external fistula; b, incomplete internal fistula; c, complete fistula; d, irregular complete fistula. B, Surface view of fistulous tracts, showing various irregular forms of fistulæ and diverticula – their external openings being marked by a star.

Operative Methods of Treating Anorectal Fistulæ: –

Curetage, with, or without closure of one end by suture.
Fistulotomy – internal scarification.
Elastic ligature.
Incision.
Simple excision.
Excision, followed by suture.

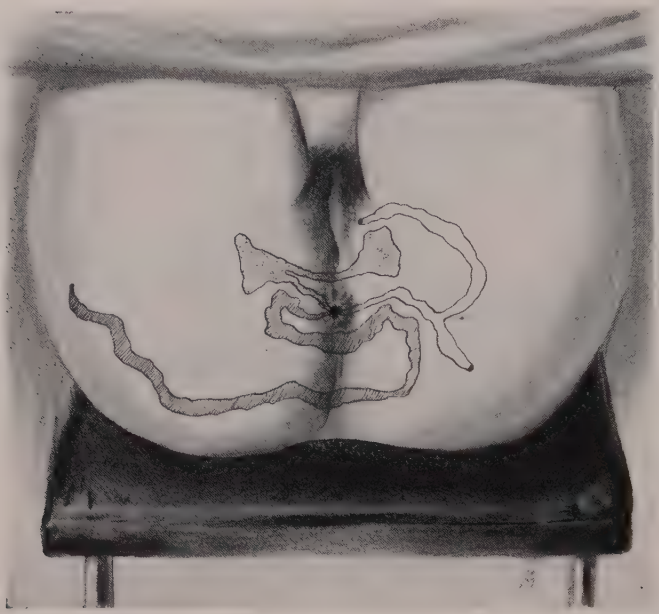
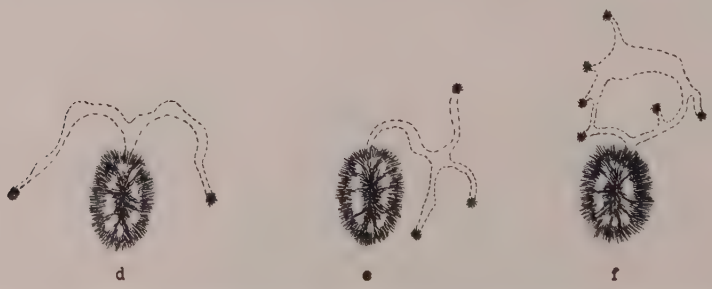


Fig. 4255.—Surface View of Anorectal Fistulæ of More Complex and Extensive Type – the external openings of two of the fistulæ being shown.

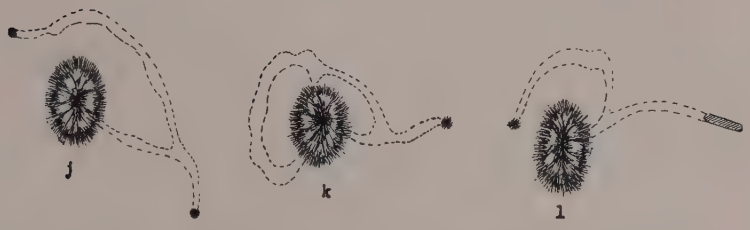
Of these methods, incision, followed by daily gauze packing of the wound, is the procedure most frequently followed – while total excision, followed by suturing of the resulting wound, is the most ideal method.



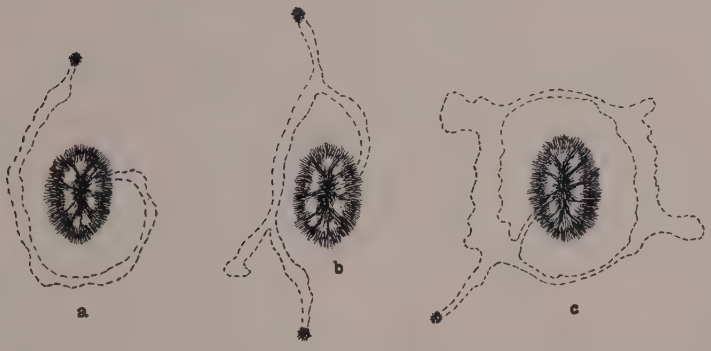
Figs. 4256–4258.—Forms of Anorectal Fistula Projected Upon the Surface; – their external openings marked by a star – and their connection with the anorectum indicated.



Figs. 4259–4261.—Forms of Anorectal Fistulæ Projected Upon the Surface.



Figs. 4262-4264.—Forms of Anorectal Fistulæ Projected Upon the Surface.



Figs 4265-4267.—Forms of Anorectal Fistulæ Projected Upon the Surface.

Anorectal fistulæ communicating with other organs will be considered under these other organs into which they open.

The preliminary treatment is the same as for hemorrhoids (p. 130).

CURETAGE OF FISTULA IN ANO—FOLLOWED, OR NOT, BY MUCOUS FLAP PROTECTION

Description.—The fistulous tract is cureted _ after which a flap of mucosa may be drawn down from above and stitched over the inner opening.

Operation.—The inner opening of the fistula is exposed under analgesia, by a univalve, or bivalve speculum, and its course and nature examined. A curet of appropriate size is then passed through the fistula, until its distal end appears within the anorectum (Fig. 4268) _ after which the curet is successively drawn down the various aspects of the tubular wall, until the tract has been thoroughly scraped. In addition, it is well to follow this by carrying through the fistula an applicator, with cotton twisted about it, dipped into pure carbolic acid, followed, or not, by another applicator dipped into alcohol. One may then do nothing further _ but as the inner end of the fistulous tract is being constantly invaded by intestinal contents, it is helpful to the technic to protect the inner end of the opening (for the length of time the sutures hold) by drawing down a small flap of mucosa and suturing it over the opening with a couple of chromic catgut sutures _ as shown in the same illustration.

Comment.—While this simple technic will certainly fail of accomplishing the cure of the fistula in the great majority of cases, it will succeed in a certain proportion of properly selected cases, as the Writer knows from personal experience. If it fails, the patient is no worse off _ and if it succeeds, he is considerably the gainer, in avoiding some larger procedure.

A trial of the curetage is especially indicated in blind external fistulæ.

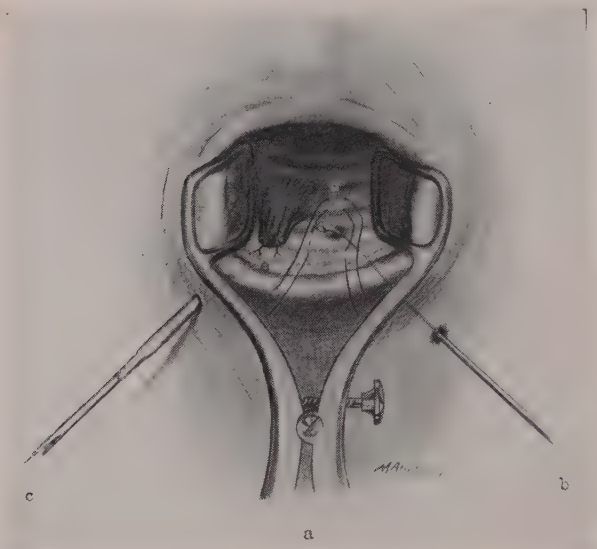


Fig. 4268.—Curetage of Rectal Fistula, Followed by Mucous Flap Protection: – a, Bivalve fenestrated speculum distending the rectum; – b, curet passing through tract of fistula, in the act of curetage; – c, cotton-tipped applicator, with carbolic acid, or other agent, to cauterize the tract; – d, sutures placed ready to draw down temporary protecting flap of mucosa; – e, mucous flap anchored over the fistulous opening with catgut sutures.

FISTULOTOMY FOR FISTULA IN ANO

Description.—The scarification of the walls of the fistulous tract.

Operation.—Having injected the vicinity of the fistula with analgesic solution, as well as swabbed out the canal with the same solution, the walls



Fig. 4269.—Use of Gant's Angular, Grooved Probe in exploring a blind internal fistula; – Use of Mathew's Fistulotome in dividing a contracted, complete fistula. For plainer understanding the distal end of the instrument projects within the lumen of the rectum, before its blades are sprung – and the walls of the fistula are cut in the act of withdrawal.

of the tract are scarified, or incised, from end to end. The scarification may be accomplished by means of a blunt-pointed bistoury _ or, more technically, by such an instrument as Mathews' fistulotome. The instrument is inserted through the outer end of the fistula and carried to its extreme opposite end, when the cutting blades are sprung and the fistulotome simultaneously drawn outward through the entire tract. It is then reintroduced _ and, similarly, made to make two incisions down other aspects of the wall _ and this is repeated until the walls have several times been incised in parallel lines. The technic is seen in Fig. 4269.

Comment.—The procedure is sometimes used in a simple, straight fistula, of small caliber _ but, together with the use of the ligature, one might class it at the lowest end of the list of desirable technics.

TREATMENT OF FISTULA IN ANO BY ELASTIC LIGATURE

Description.—A ligature, preferably elastic, sometimes silk, is carried through the fistuous tract, and tightly tied, or clamped _ and there allowed to remain, with or without occasional tightening, until it cuts its way out.

Operation.—A small, round, solid rubber ligature, about 2 mm. ($\frac{1}{12}$ inch) in diameter, threaded through the eye of a probe (Fig. 4270) is carried through the course of the fistula _ leaving the two free ends upon the skin surface. The ligature is then drawn tightly, and is tied in a square knot (Fig. 4271). Or the ligature may be clamped with a split shot, with or without a protecting metal shield between the shot and the skin. To avoid unnecessary pain the skin is superficially incised where the rubber cord will press. The ligature requires from five to fourteen days to cut its way out.

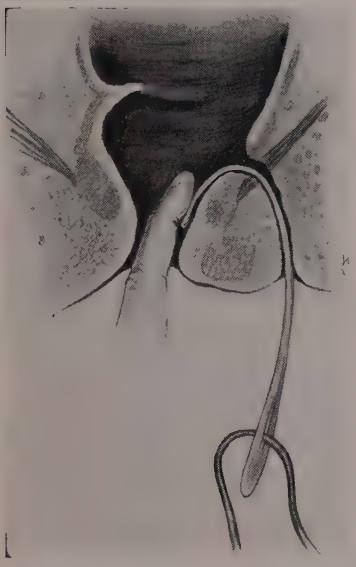


Fig. 4270.—Operation Upon Anorectal Fistula by Elastic Ligature _ I; _ A solid rubber cord is being carried through the fistulous tract, threaded through the eye of a probe _ guided by a finger in the rectum.

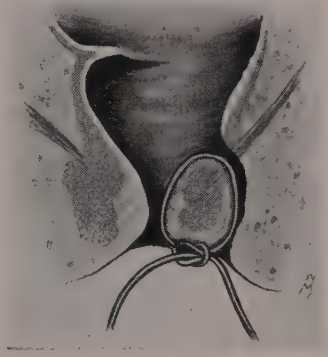


Fig. 4271.—The Same _ II; _ The rubber cord has been tightened and tied in a square knot.

Comment.—The method would seem to be very crude and undesirable.

OPERATION FOR FISTULA IN ANO BY SIMPLE INCISION, FOLLOWED BY CURETAGE AND PACKING

Description.—The fistulous tract is here laid open, usually upon a grooved director passed through its course, employing knife or scissors _ after which

the bed of the fistula is cureted, and packed with gauze, which is daily renewed, until healing by granulation occurs. This is the most frequently practised method of operating for fistula in ano. The basis of the operation is the severing of the sphincteric apparatus, and the putting of the part at rest during healing. In dealing with complete fistulæ the entire tract is incised _ whereas, in the incomplete type, the tract is laid open, from its opened to its closed or blind end.

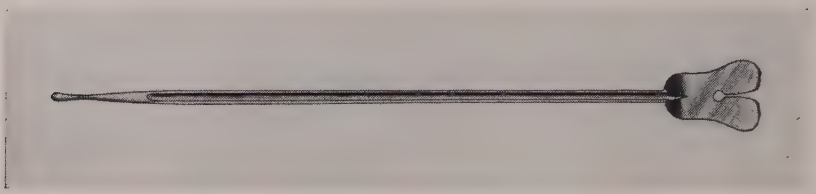


Fig. 4272.—Probe-pointed Grooved Director.

Preparation.—Purgation; rectal irrigation; shaving of circumanal region; dilatation of the sphincter just before operation, in the more complicated cases, following anesthesia. Analgesia, without dilatation, in simpler cases.

Position.—Patient in the lithotomy position, with nates over the end of the table; surgeon sitting opposite the perineum.

Landmarks.—Anus; rectum; course of fistula and position of openings determined in advance, if possible.



Fig. 4273.—Incision of Fistula in Ano _ I: _ Grooved director carried from without, through the fistulous tract into the rectum _ until in contact with the tip of the finger within the rectum.

Operation.—A probe-pointed, grooved director (Fig. 4272) is passed through the sinus, from its skin opening _ made to traverse its length and emerge through its internal opening within the bowel (Fig. 4273) _ and the end of the director is then caused to project through the anus by directing its tip with the left index-finger within the rectum, while its handle is depressed with the right hand (Fig. 4274). The external and internal openings of the fistula are then in plain view _ with the grooved director pass-

ing through its entire length. (See Fig. 4283, A.) Upon the grooved director a narrow, pointed knife is passed (or a probe-pointed bistoury may be used) with its cutting-edge directed outward – thus incising the fistula throughout its entire course, the incision crossing the sphincters at a right angle to their



Fig. 4274.—The Same – II; – The end of the grooved director has been brought down through the anus by the finger of the left hand – compressing and delivering the entire area of the fistula outside of the rectum and anus. This maneuver is facilitated by using a slightly curved director.

course (Fig. 4275) – freeing the grooved director and allowing the parts to recede into their normal positions. The lips of the wound and of the sinus are then separated by the Operator's left thumb and index – and, while thus exposed, the entire extent of the fistula should be scraped with a curet, so as to remove its old wall (Fig. 4276) – and then lightly packed with gauze and

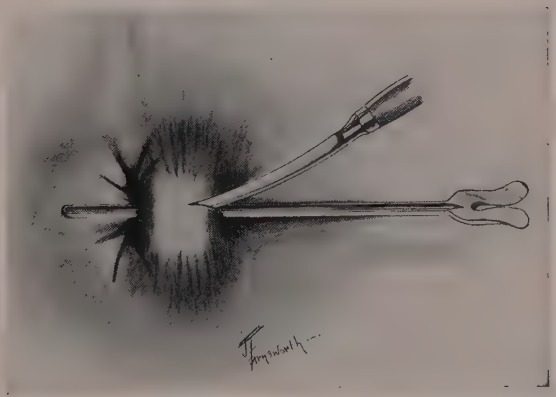


Fig. 4275.—The Same – III; – A bistoury is made to traverse the course of the grooved director from handle toward tip, or vice versa – severing the overlying soft parts throughout, down to the bed of the fistula – and dividing the sphincter directly transversely to its fibers.

allowed to heal from the bottom. A T-bandage keeps the dressing in place. The bowels are usually kept constipated for a few days.

Comment.—It is of paramount importance that section of the sphincter muscles should be made at a direct right angle to the course of their fibers at

the point of section – the difference between the right angle and the oblique division of the sphincteric fibers is seen in Fig. 4277. The practical impor-

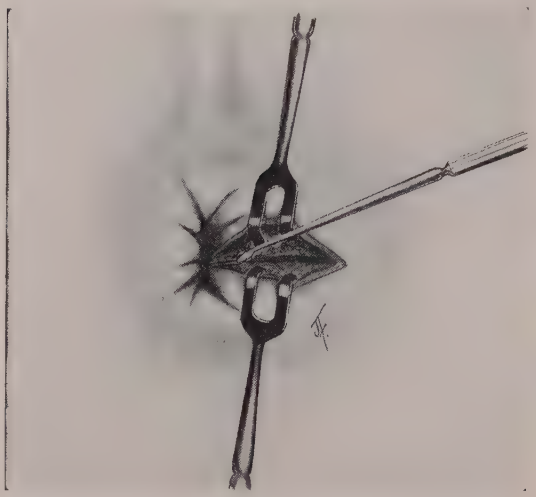


Fig. 4276.—The Same – IV; – The lips of the wound are well retracted – and the bed and sides of the fistulous tract are thoroughly cureted – after which the wound is packed.

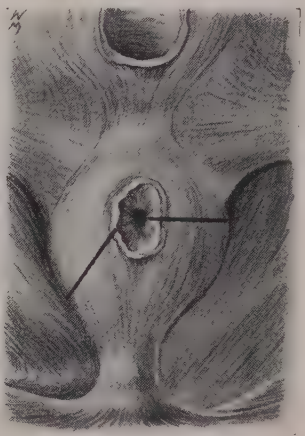


Fig. 4277.—Divisions of the Sphincter in Fistula in Ano; – Correct method of incising – at right angles to the muscle-fibers (as shown on the patient's left). Incorrect way of incising – obliquely through the fibers of the muscle (as upon patient's right).



Fig. 4278.—Incision of an Oblique Fistula by Transverse Division of the Sphincter – I; – Grooved director has followed the course of the fistula from its external to internal opening, obliquely across the sphincter. To enable the incision to divide the fibers of the sphincter muscles at right angles one blade of the Mayo scissors is thrust through the tissues, at an angle to the course of the fistula – which are then divided sufficiently for the cut to cross the sphincters transversely.

tance of this is great – as fecal incontinence is much more apt to follow oblique division of the sphincters than direct, rectangular division. The functional repair of the divided musculature is much more complete after direct trans-

verse division than it is after oblique division. It may happen that the external and internal openings are not in such relationship as to make the transverse division of the muscles readily accomplished, as shown in Fig. 4278. In such a case as this the grooved director should be passed in the usual manner, as shown in the above illustration, after which an incision should be made, conveniently with scissors, at an angle to the course of the probe and fistula (as pictured above), and to the outer side of the external sphincter, undercutting, as well, where necessary, until the grooved director can be lowered or changed to such a position as to enable the muscle to be cut at right angle (Fig. 4279).

Sometimes the course of the fistulous tract is so devious that the grooved director cannot follow it – but must be pushed through some solid barrier intervening between the openings – and if this barrier be inconsiderable, no harm results (Fig. 4280). Although when the part is laid open some minor

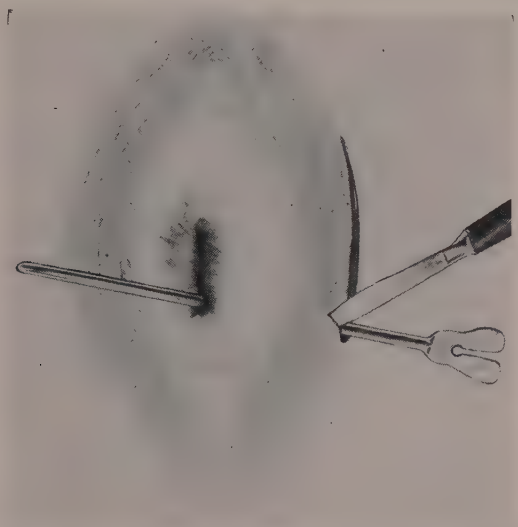


Fig. 4279.—The Same – II; – The grooved director is brought forcibly from its original position to the lower limit of the scissor-made wound – and along its groove a knife is pushed through the overlying soft parts, directly at right angles with the fibers of the sphincters – dividing the tissues and exposing the bed of the fistula.

complications may be presented by the irregular bed of the incision. It is particularly in such cases as these that every furrow, burrow, and irregularity of the fistulous bed must be traced to its very bottom.

Some Surgeons adopt the routine of dilating the sphincter, if the operation does not involve its division – and some dilate it at the beginning of the operation, independently of its subsequent division, or not. The object, practically, is to temporarily suspend the function of the sphincteric apparatus.

Sometimes a fistulous tract can be better followed and incised from the anorectal than from the cutaneous end – after full stretching of the sphincters.

The course of the fistula may be such from its tortuosity that it is not possible to insert the grooved director and incise it but for a short distance, at a step – to be followed by its further passage, in the same, or a different direct

tion, and incision, at the next step – and thus may a large horseshoe fistula, surrounding the anorectum at a distance of several inches, require a dozen different entries of the grooved director and incisions thereupon – before its entire circuitous course is laid open. The ultimate incision may be more than a foot in length (see Fig. 4255, already quoted).

The general rule is that no matter whither a fistula leads, thither must it be followed – and incised – the main channel, and its diverticula.

The hemorrhage encountered is usually controlled by gauze pressure – although any visibly bleeding vessel should be tied with fine catgut.

A rectal tube should be inserted, at the end of the operation, to furnish an escape for distending flatus.

In blind external fistula one should, as a rule, try to avoid opening up the tract into the bowel, as matters are simplified by avoiding its further infection.

In blind internal fistula, effort should be made to open up the outer blind end, which usually lies comparatively near the surface – and then pass a grooved director and lay open the entire tract.

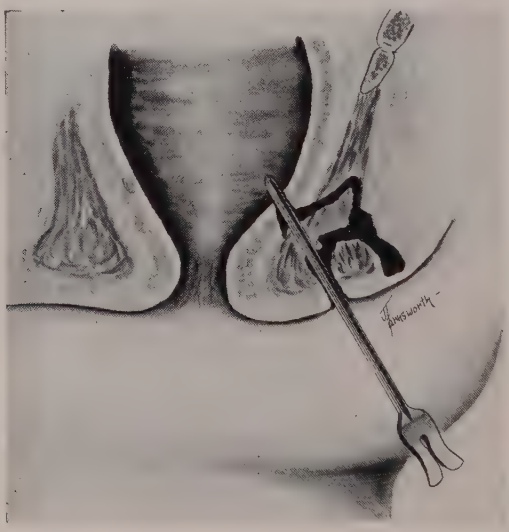


Fig. 4280.—Incision of a Fistula Upon a Grooved Director Passed Through the Entrance and Exit of the Fistula Without Following the Entire Tract.

A glance at Figs. 4245–4267 will convince one how complex may be some of the cases encountered.

Every effort must be made to avoid dividing the sphincters in more than one place – and that at right angles. A great deal of ingenuity is sometimes called into play in avoiding irreparable damage to the sphincteric apparatus – and, at the same time, to consistently incise all fistulous tracts.

It is sometimes wise, in extensive involvements, to operate in two, or even more stages, with time for healing to occur between them. Thus some very complicated involvements are occasionally considerably simplified.

The bowels are usually artificially moved on the fourth day. The ultimate time for healing will vary with the wound – an extensive, complicated case may require several months before the wound is closed by granulation

The wound following incision should be irrigated daily – some stimulating solution be brought into contact with it, such as a 5 per cent. solution of balsam of Peru and castor oil, or 10 per cent. solution of ichthyol and glycerin – after which gauze should be placed (not packed) in the wound. It is well for the patient to remain in bed for a week or ten days.

In those cases where the internal opening of the fistula comes out above both sphincters, an attempt should be made, after the incision, to dissect out the upper portion of the fistulous bed and suture together that portion of the wound, including the internal sphincter. This gives some bowel control – and the sutured part of the wound usually heals, as the lower portion is open for free drainage.

In operating upon blind internal fistulæ, a curved, shepherd's-crook knife is sometimes useful.

Whenever the grooved director has to be bodily pushed through any portion of tissue, after the part is laid open by incision, the vicinity of the part pushed through must be carefully examined for diverticula radiating from this site – and these be carefully followed to their end, and laid open or cureted.

If the grooved director does not pass readily, a probe may first find the way – and the director passed along this – and the probe then withdrawn.

If the grooved director or probe cannot be made to find an internal communication with the bowel, but nevertheless comes very near the mucous membrane, it may be forced the remaining distance, provided this distance be short and the part be afterward examined – if this technic be indicated.

If the end of the director cannot be brought out through the anus, a narrow, probe-pointed bistoury may be passed along it and the director withdrawn – and then the end of the probe-pointed bistoury is pressed against the surgeon's left index-finger introduced within the rectum – and finger and knife simultaneously withdrawn – the knife cutting the intervening soft parts through in its withdrawal. Or one blade of a pair of scissors may be passed along the director and the sinus thus laid open.

In incomplete internal fistulæ the internal opening is found through a speculum – a bent probe passed along the sinus – and an external opening made where thus indicated – after which the operation is completed as in a complete fistula.

OPERATION FOR FISTULA IN ANO BY INCISION OF THE FISTULA AND EXCISION OF ITS BED, FOLLOWED BY SUTURE OF THE WOUND

Description.—The operation here designated is similar to the one just described, up to the laying open of the fistula – after which the bed of the sinus is dissected out, and the margins of the wound closed. It is applicable to the medium type of simple fistulæ, of moderate length and straightness of course.

Operation.—The entire length of the fistula is traversed by a blunt-pointed grooved director (Fig. 4281). The overlying soft parts are then slit open, the sphincters being crossed at a right angle (Fig. 4282). The granulation bed of the split fistula is then carefully and entirely excised. This is best accomplished by seizing its margins with forceps and dissecting out the unhealthy tissue with a knife, or with sharp-pointed, curved scissors, while the loosened portion of the bed is held under slight tension by the forceps (Fig. 4283, B). Finally, the sides of the wound are brought together by sutures – either alternate superficial and deep silk, or linen sutures (Figs. 4283, C, and 4284), or by a buried row of catgut sutures, and a superficial row of silk or silkworm filament.



Fig. 4281.—Operation for Fistula in Ano by Incision of the Fistula, Excision of its Bed and Suturing of the Wound _ I; _ Grooved director passed through the entire length of the fistula and into the rectum _ the end of which is then brought out upon the perineum.

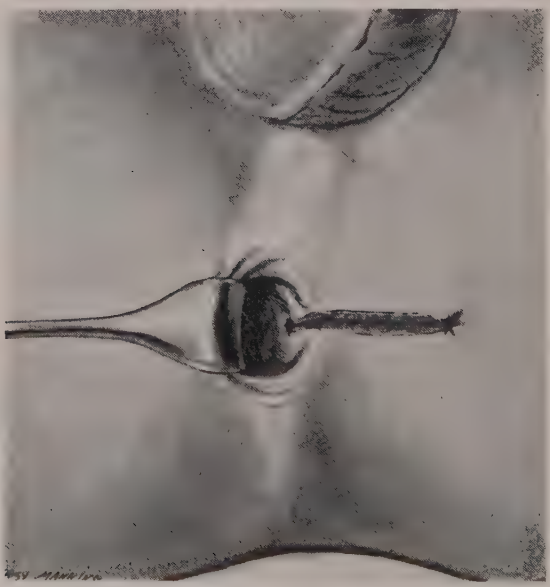


Fig. 4282.—The Same _ II; _ The fistula has been laid open to its bottom, throughout its entire length after which the bed of the sinus is excised.

Comment.—This procedure presents some of the features of the treatment of a fistula in ano by excision followed by suturing _ which, ideally, is the operation of choice. But the present technic may be adopted under two special conditions, _ First, when, for one reason or another, it is not possible to excise the unincised fistula, _ and, second, when, on laying open a fistula,

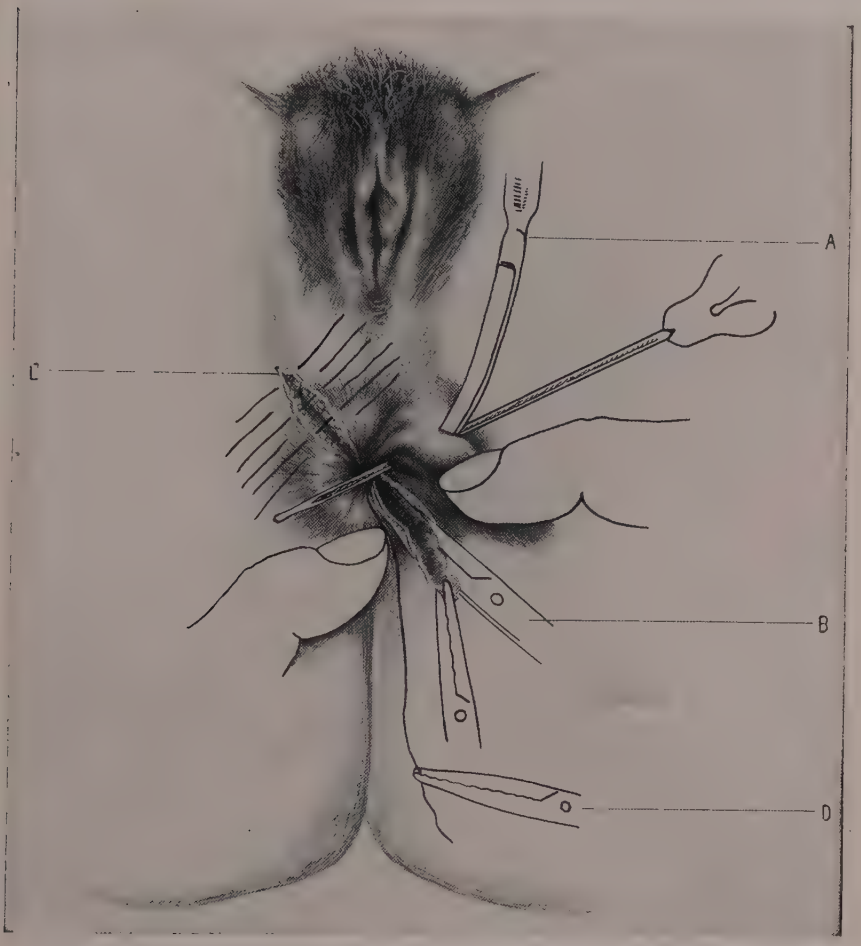


Fig. 4283.—Operation for Fistula in Ano by Incision of the Fistula, Excision of its Bed, and Suturing: _ A, Bistoury in act of diviiding fistula upon grooved director; _ B, fistulous tract being excised by curved scissors, while steadied wth forceps; C, suturing of bed of sinus after its excision; _ D, ligature attached to gauze tampon in rectum to control contents.

the treatment of which was planned to be by incision alone (or incision with curetage and packing), it is found that conditions are present which make it seem possible to entirely excise the entire fistulous tract (although already split open) and to completely suture the wound _ thereby saving the patient great delay in convalescence.

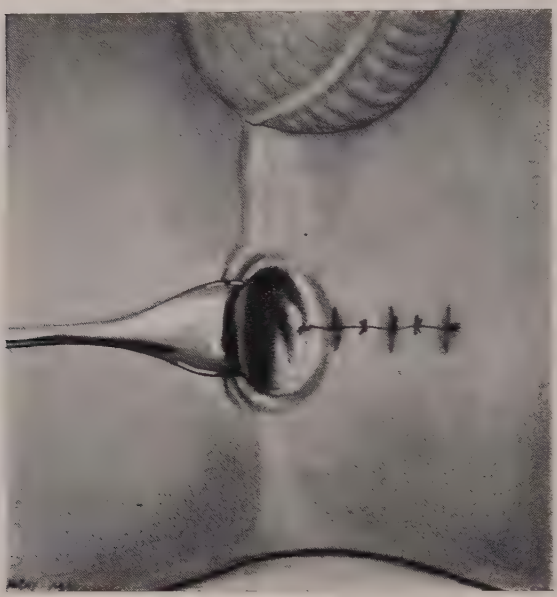


Fig. 4284.—The Same—III;—The sinus tract is closed throughout by sutures—superficial and deep—or by buried and superficial sutures.

OPERATION FOR FISTULA IN ANO BY SIMPLE EXCISION, FOLLOWED BY PACKING

Description.—This is one of the oldest types of operation. The fistulous tract is simply excised—and its bed, packed from time to time with gauze, is allowed to heal by granulation. The technic invites long convalescence—which it is sought to avoid in the operation to be next given. The especial field of application for this method of operating are those cases where the fistulous tract is surrounded by considerable fibrous scar tissue. It affords the opportunity of getting rid of this adventitious tissue. It must not be applied, however, in those cases where the scar tissue is so extensive that the cut ends of the sphincter will be kept too far apart in the act of healing.

Operation.—The operation may be carried out exactly as is the one next to be described—except that, following excision of the fistulous tract, the margins and depths of the wound are not sutured together. Or the operation may be carried out as is the one last described, omitting the suturing. Finally, the wound is simply lightly packed with gauze, which is renewed from day to day—exactly as is practised in the treatment of fistula in ano by simple incision.

OPERATION FOR FISTULA IN ANO BY EXCISION, FOLLOWED BY SUTURING

Description.—The fistulous tract is entirely excised—and the resulting wound completely closed by suture. This, unquestionably, is the most ideal operation for anorectal fistulæ in all cases in which it can be carried out. Unfortunately, primary union of the sutured parts and obliteration of the fistulous tract does not always occur, due, very naturally, to several chief causes,—the difficulty of securing primary union in wounds of any kind involving these parts,—the especial difficulty in the case of wounds, one end of which are constantly bathed with fecal discharge, as anorectal fistulous tracts are—

the omission of technical detail in the total removal of all diseased tissue, directly and indirectly connected with the main tract (such as secondary sinuses). These conditions sufficiently account for the proportion of failures _ which, however, are not sufficient to cause the abandonment of the technic _ but, rather, its greater perfecting.

The method is especially applicable to complete fistulæ not too deep, nor too long, nor opening too high up in the rectum _ and to incomplete external (blind) fistulæ, which because of not communicating with the rectum, are saved that source of infection. As one becomes better satisfied with his management of the technic, however, the method is extended to longer, larger, deeper, less simple fistulæ.



Fig. 4285.—Excision of a Rectal Fistula, Followed by Suturing _ Tuttle's Technic _ I: _ a, Pliable probe passed through the entire course of the fistula, from the skin outlet to the rectal mucous inlet, with the ends bent backward, to form the means of handling; _ b, knife excising wedge-shaped piece of tissue, including the entire fistulous tract, with outlet and inlet; _ c, Hirschman's retractor distending the anorectal orifice.

Operation.—The technic consists, fundamentally, in excising the tract and suturing the wound (which had its origin with Chassaignac in 1856) _ howsoever these ends may be brought about. Tuttle, however, worked out a technic which considerably simplified the act of excising the tract _ which is the starting-point and the most difficult part of the operation.

The patient is prepared by purgations, rectal flushings, and fistulous irrigations with antiseptic solutions _ for several consecutive days in advance of the operation. The anorectal orifice is stretched at the time of operation. A pliable silver probe, long enough to be bent at either end and used as a handle, is run through the entire tract of the fistula _ after which the portions projecting from the ends of the fistula are bent toward each other. One then proceeds with the excision of the tract through which the probe has been passed _ the excision being accomplishable in one of two ways: _ Either two parallel incisions may be made but a short distance apart, and immediately over the

fistulous tract, now better outlinable because of the presence of the probe – the incisions being then deepened down, V-fashion, to include the entire more or less fibrous tract (Fig. 4285), or a single incision may be made directly over the probe, from one opening to the other, and the overlying parts dissected back a little to each side – after which the operation is proceeded with in the same way, no matter by which method it began. The dissection is carried down to and around each lateral aspect of the fistulous tract with its surrounding fibrous walls. When the position of the sphincter muscles is reached, these are incised in a straight line directly transversely to their course – after which the cut ends of the muscles are displaced to each side, while the operation is being completed, to be sutured together at its end. The incision is carried around the two ends of the fistulous tract – but nowhere invades the tract – the dissection being everywhere deepened, until the entire tract is excised – and, together with the probe still *in situ*, removed. If, in the dissection the knife or scissors penetrate into diseased tissue, the instrument should be changed for another, to avoid infecting sound tissue.



Fig. 4286.—The Same – II; – Closing the site of the fistula – sutures in the anorectal region have been tied. Those in the skin region are placed, ready for tying. Two untied sutures pass through the rectal mucosa, ready to bring down a mucous flap to mechanically protect the suture line from fecal soiling.

The deeper plane of the wound is now closed by buried catgut sutures – accurately approximating all parts so as to leave no space for the accumulation of fluids – after which superficial marginal sutures are applied (Fig. 4286). Or, and this method is probably better, several deep silkworm are first carried deeply under the bed of the fistulæ – after which the superficial sutures are placed and tied – and then the deep relaxation sutures are tied. This terminates the usually carried out type of operation.

In order to protect the innermost or anal end of the sutured incision against fecal soiling, Tuttle made two little slits in the anal mucosa, just within the anal orifice, outlining a tiny mucous flap, which he superficially detached and brought down over the anal end of the suture line and held there by two sutures through skin and mucosal flap. Instead of doing any cutting of the mucosa, the Writer would suggest (as he has employed within the vagina in rectovaginal fistula) bringing down a small flap of redundant mucosa and holding it over the anal end of the incision by two stitches – the method of

placing the rectal part of the stitches having been shown in Fig. 4286 – and the tying of these, upon the skin aspect, in Fig. 4287. Of course there is no union, as there is no raw surface – and the stitches soon cut through – but af-

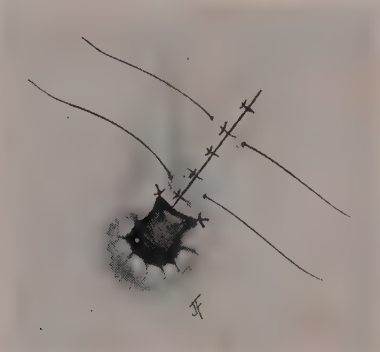


Fig. 4287.—The Same – III; – The entire bed of the excised fistula is closed by interrupted sutures. Two relaxation sutures are placed to relieve direct tension upon the lips of the wound. The rectal mucous flap is drawn out over the anorectal border and anchored to the adjacent skin by two sutures – thus temporarily protecting, mechanically, the rectal portion of the wound from fecal soiling.

ford protection in the meantime, during which time union is shutting off the wound.

Any portion of the sphincters divided in excising the tract are carefully reunited by buried catgut sutures.

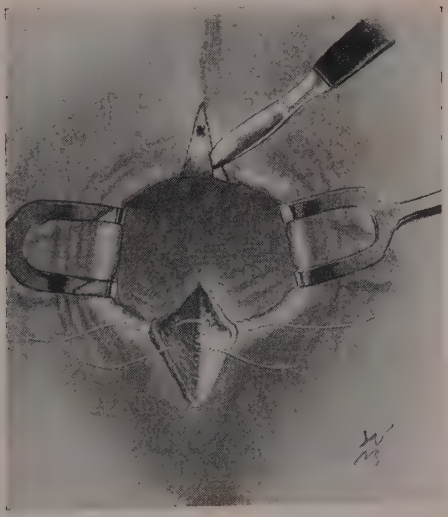


Fig. 4288.—Excision, En Masse, of Fistula in Ano, Followed by Suturing; – The fistulous tract in the upper periphery is being excised by the removal of a wedge-shaped piece from the anal margin to beyond the site of the fistula. A similar, larger excision has been done posteriorly – and the wound partly closed by deep, buried, and by superficial sutures.

Finally, a drainage-tube is introduced into the rectum, and the dressing applied.

The patient is kept in bed, constipated, and with opium for six or seven days, and then the bowels are opened by enema.

Comment.—In Fig. 4288 is shown a *fistula in ano* in the act of being excised and its bed sutured not by dissection, but *en masse* – the technic being applicable under favorable conditions.

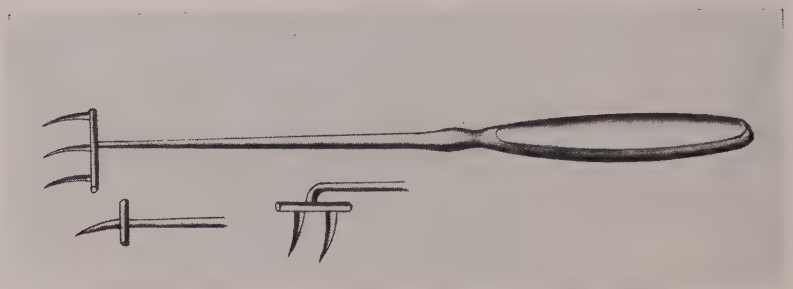


Fig. 4289.—Bryant's Forks for Holding the Edges of Fistulæ.

Convenient forms of marginal approximators, for holding the edges of the wound in contact during suturing, are shown in Fig. 4289.

OPERATIVE TREATMENT OF FISSURE OF THE ANUS

Description.—An anal fissure is a solution of continuity in the mucocutaneous tissues of the anal orifice. A fissure of the anus is as well an ulcer of the anus. Several operative methods of treating this condition are in use. Most operative procedures are best performed after anorectal dilatation under anesthesia.

Operative Treatment of Fissure in Ano by Dilatation.—The patient is placed under anesthesia, and the anorectal orifice fully stretched – either by means of the thumbs, as in dilating prior to operating for hemorrhoids (v. p. 133), or by other digital technic – or by means of some form of instrumental divulsor. The object of the stretching is to sever connecting muscle-fibers and nerve filaments – thereby securing relief of pain and rest for healing by interrupting the muscle spasm. Stretching may be gradual or forcible. The sphincter muscles are purposely overstretched or actually ruptured. A rectal tube is left *in situ* for nearly a week. While healing frequently follows dilating or divulsion, yet the method is more or less crude, if not brutal – and extensive laceration and permanent incontinence have sometimes followed. Other methods are preferable.

Operative Treatment of Fissure in Ano by Curetment.—The bed of the fissure or ulcer may be thoroughly cureted down to healthy tissue (Fig. 4290). The site of curetage is subsequently protected by gauze impregnated with some stimulating substance, such as balsam of Peru and castor oil – the part being cleansed and the dressing changed after each bowel movement. Occasionally success will follow this simple technic. It is worth trying in appropriate cases.

Treatment of Fissure in Ano by Incision.—In this method the fissure or ulcer is incised through its base – under anesthesia – and following anorectal dilatation. The procedure is sometimes carried on under analgesia. Two methods of incising the bed of the fissure or ulcer are in use – the incisions, in both cases, passing entirely through the bed of the fissure.

(*A*) Incision of the Fissure by a Single Axial Incision: A straight, probe-pointed knife is carried above the upper end of the fissure – and passes down through the entire thickness of the center of the bed of the fissure, from just above its beginning to just below its ending – and dividing about one-third

of the thickness of the external sphincter. The split fissure may sometimes be further helped by curetage – or its curetment may precede the dilatation. Subsequent to the incision the incised tract is packed lightly with gauze.

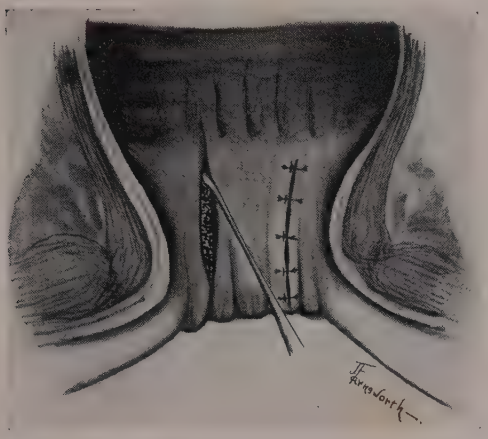


Fig. 4290.—Treatment of Anal Fissures: – Line of interrupted sutures, closing the bed of excised ulcer (in Fig. 4294). Curet, scraping the bed of a fissure.



Fig. 4291.—Muscular Incisions for Anorectal Fissures; – Posteromedian incision which only separates the fibers of the sphincters; – V-shaped, bilateral incisions, crossing the cut portion of the sphincters at right angles, and putting them at rest.

(*B*) Treatment of Commissural Fissures of the Anus by V-shaped Incisions: If the fissure be situated at the anterior or posterior commissure of the anus, a single axial incision will simply split the external sphincter, without dividing its fibers, and, hence, not put the part at rest. To obviate this a V-shaped

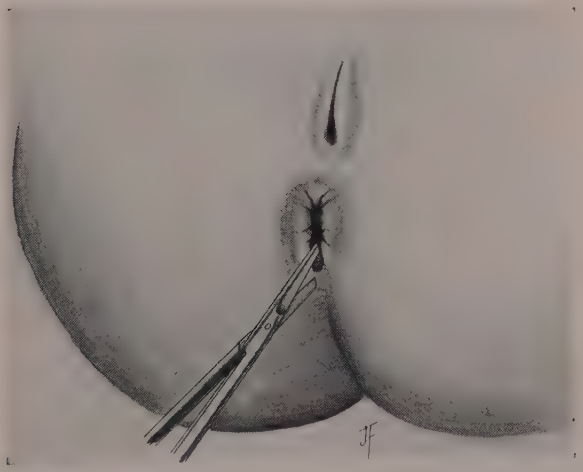


Fig. 4292.—Gant's Method of Incising the Sphincter with Scissors in Anorectal Fissure. The scissors should cut in the median line.

incision is made, as shown in Fig. 4291. The incisions cut the fibers of the external sphincter on both sides, and at a right angle to their course. The incision should be somewhat longer than the site of fissure or ulceration – and should pass about 6 mm. ($\frac{1}{4}$ inch) deeper than the deepest part of the ulcer.

(*C*) Incision of Fissure in Ano by Scissor-stab Cut: Gant divides the fissure by making a scissor-stab with one blade of the scissors, from the skin surface,



Fig. 4293.—Excision of a Mucocutaneous Anal Fissure; – The right margin of the fissure has been outlined by incision: – a, Needle carrying analgesic fluid, passing beneath the bed of the fissure; – b, forceps grasping the left margin of the fissure and tensing it for the knife cut, c. A wedge-shaped portion of tissue is thus excised.

through the substance of the external sphincter – and closes the other blade down upon it in the act of cutting through the fissure (Fig. 4292).

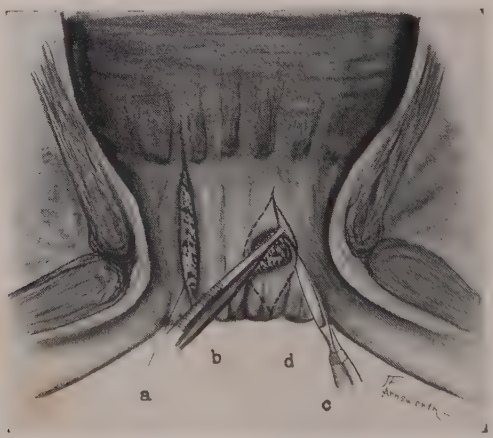


Fig. 4294.—Anorectal Fissure and Ulcer: – a, Fissure, such as may result from the breaking down of a crypt of Morgagni; – d, irregular fissure or ulcer; – b, forceps tensing the lip of the area to be excised; – c, knife excising the site of the ulcer by elliptic incison.

Treatment of Fissure in Ano by Simple Excision.—The fissure is here simply excised, and no attempt made to suture the resulting wound, which is left to granulate. The site of fissure is steadied by forceps, while the bed of

the fissure, including all cicatricial tissue, is excised with knife or scissors. The technic is shown in Figs. 4293 and 4294, c, d.

Treatment of Fissure in Ano by Excision, Followed by Suture.—Where it is possible to do so, this is the ideal method. The fissure or ulcer is excised in the manner just described – after which the margins of the resulting wound are brought together and sutured with fine chromic catgut. Operating in the locality in question, upon such an unfavorable pathologic condition, it is natural that infection should frequently occur, and primary union fail – but where it succeeds, one is a long way ahead – and where it fails, one

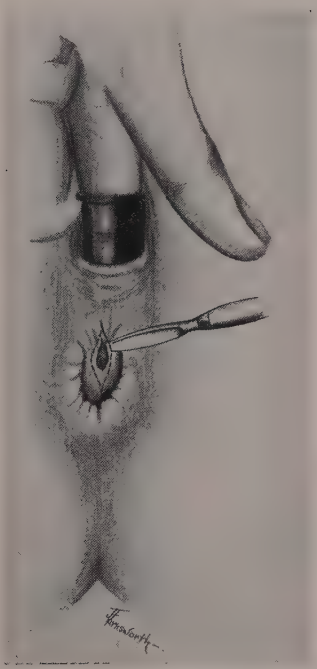


Fig. 4295.—Eversion of an Anterior Anorectal Fissure – by introducing a finger into the vagina during the act of excising the fissure or ulcer.

is no worse off than though no attempt had been made to suture the wound resulting from excision.

By everting the rectal mucosa by a finger in the vagina in the case of a female a rectal fissure may often be advantageously exposed for operation (Fig. 4295).

PROLAPSE OF THE RECTUM, IN GENERAL

The nomenclature and basis of divisions of prolapse of the rectum are particularly unsatisfactory. Further, rectologists are not in agreement as to the significance of the designations of the different conditions, as unsatisfactory as they are. This is especially unfortunate, as it causes some confusion in the applications of measures for relief – for, very manifestly, procedures which may be helpful in one form of prolapse may be harmful in another.

Classification of the Forms of Rectal Prolapse as Generally Employed:–

(*A*) Partial (or Incomplete) Rectal Prolapse – in which the mucosa alone prolapses.

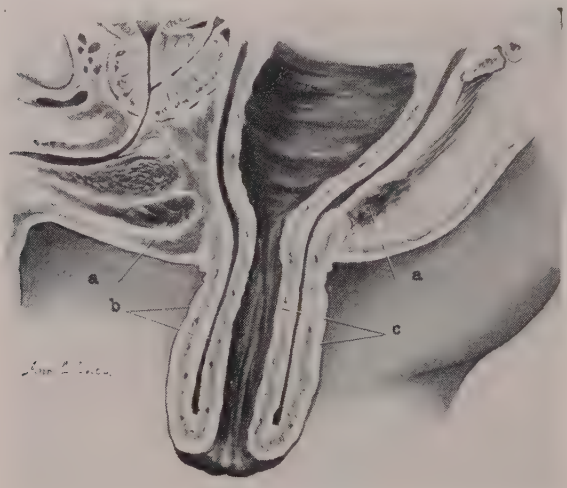


Fig. 4296.—Complete Prolapse of the Rectum, First Degree: – a, a, Sphincters ani; – b, outer wall of the bowel; – c, inner wall.

(*B*) Complete Rectal Prolapse (or Procidentia Recti) – where all the coats prolapse.

(*a*) Complete Prolapse of the First Degree (Fig. 4296), in which the prolapse begins at the anal margin, and its outer surface is continuous with the perineal skin.

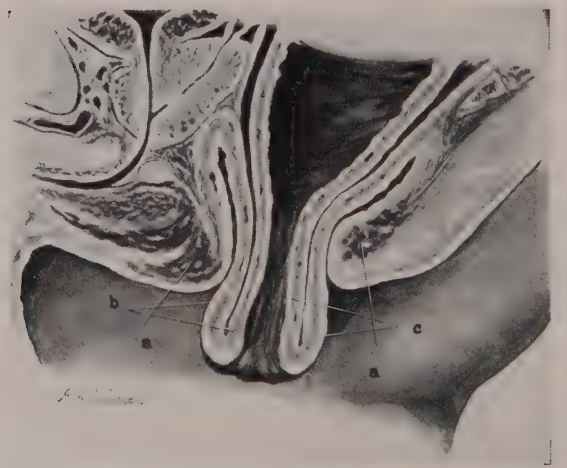


Fig. 4297.—Complete Prolapsus Recti, Second Degree: – a, a, Sphincter ani; – b, outer wall of the bowel; – c, inner wall of the bowel.

(*b*) Complete Rectal Prolapse of the Second Degree (Fig. 4297), where the prolapse commences at some level above the anus, and prolapses through a part of the rectum still *in situ*, and on through the anus.

(*c*) Complete Rectal Prolapse of the Third Degree (Fig. 4298), where the prolapse commences at some higher level of the sigmoid, or rectum, and extends down into the rectal ampulla, but does not project through the anal orifice (constituting an invagination of the sigmoid or rectum into itself, without appearing outside of the body).

Partial rectal prolapse, and complete rectal prolapse of both the first and second degrees, projecting, as they do, from the normal anal orifice, speak for themselves. Complete rectal prolapse of the third degree, however, may not

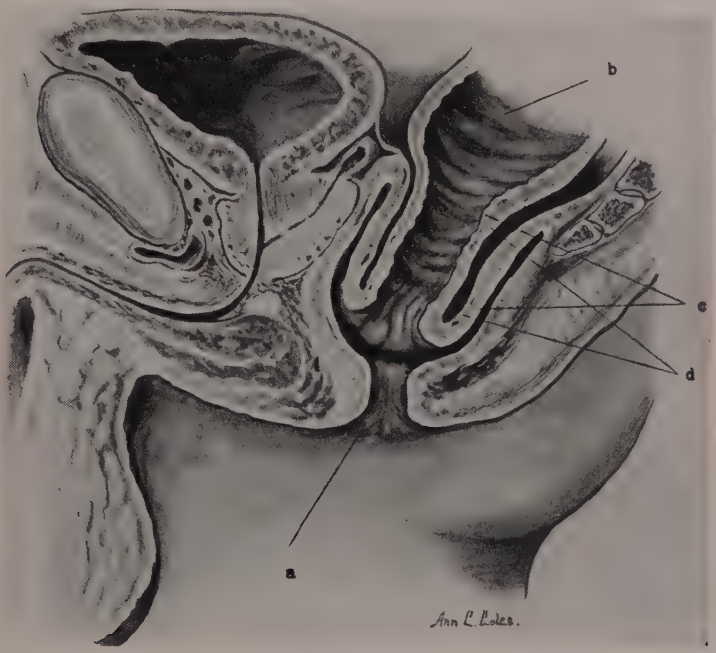


Fig. 4298.—Complete Prolapsus Recti, Third Degree: – a, Anal orifice; – b, normal rectum; – c, prolapsed segment of rectum; – c, inner rectal wall; – d, outer rectal wall.

be suspected until discovered by digital examination, or through the speculum (Fig. 4299).

The operations most frequently adopted for the different forms of prolapse will be considered.

Methods of Operating for Prolapse of the Rectum.—Partial, or incomplete prolapse of the rectum, in which only the mucosa comes down, may often be successfully met by some of the simpler procedures – such as those procedures mentioned under this heading in the operations about to be described.

More marked cases of complete rectal prolapse, of all the coats of the bowel, are less apt to be permanently cured by the simpler methods – and it is in these cases that methods of total excision of the prolapsed segment, or intra-abdominal fixation, as described under the operations of Sigmoidopexy (which, while fixing the sigmoid, draws up the rectum), yield the best results.

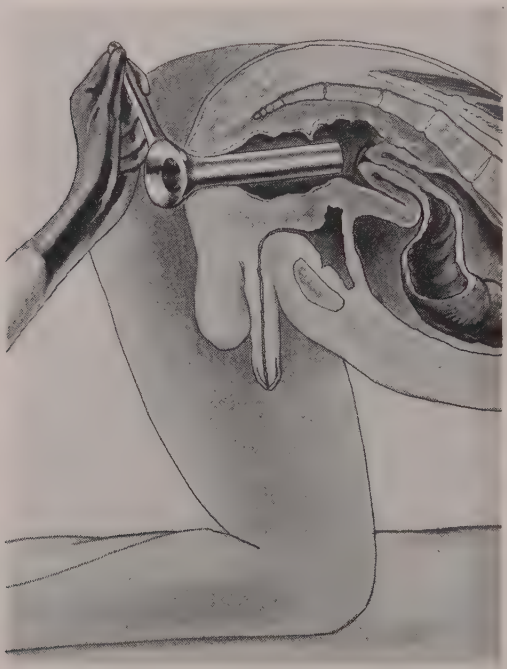


Fig. 4299.—Exposure Through the Speculum of an Invaginated Sigmoid – Prolapse of the third degree.

OPERATION FOR PROLAPSE OF THE RECTAL MUCOSA (PARTIAL RECTAL PROLAPSE) BY LINEAR CAUTERIZATION

VAN BUREN'S TECHNIC

Description.—This method is chiefly of application in the case of children, where repeated efforts by even simpler methods have failed.

Operation.—Under anesthesia, in the lithotomy position, the protruded rectal mucosa is cauterized by a series of axially placed parallel lines, extending from the anal orifice into the apex of the everted mucosa – with a red-hot cautery point (Fig. 4300). The number of the lines cauterized will depend upon the degree of prolapse. And if the anal orifice be unusually patulous, the cauterization will also include its margin, and into some of the fibers of the external oblique. The part is then re-inverted into the anorectal canal – by means of a small plug, finger-shaped, of cotton, or gauze, smeared with vaselin. The part is finally held in position by cicatricial contraction.

Sometimes a fenestrated or valvular speculum is used – and the cauterizations made through the windows or between the blades – but the method first mentioned is preferable.

The child is kept in bed for a couple of weeks – its bowels being moved in four or five days, after throwing some olive oil into the anorectal canal, as a lubricant to aid in the first passage. It is well for all bowel movements to take place on the back, or, better, side, for three or four weeks, and preceded by the local lubricant.

Occasionally the cauterization must be repeated – in the intervals between the original lines of cauterization.

In adults, a broader cautery point is employed.

The rectal tissue is burned down to the muscular wall – carefully avoiding full penetration of the bowel. If penetration were to occur upon the anterior aspect of an extensive prolapse, the peritoneal cavity would be due to be entered.

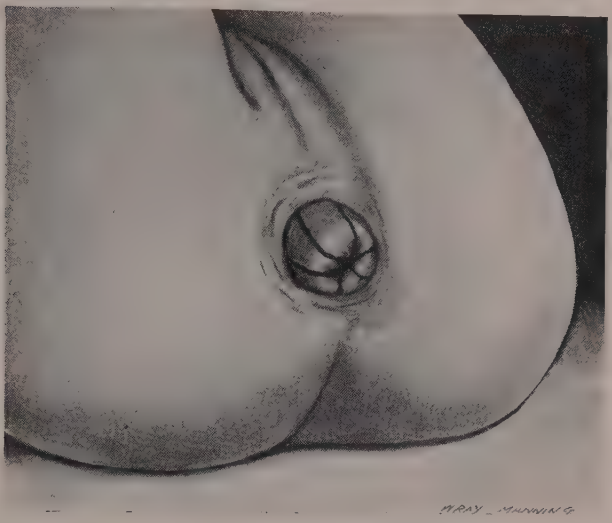


Fig. 4300.—Cauterization of the Rectal Mucosa – in prolapse of the rectum in children.

It is well to introduce a small rectal rubber tube past the site of operation, and allow it to remain in position for a time.

OPERATION FOR PROLAPSE OF THE RECTAL MUCOSA (PARTIAL RECTAL PROLAPSE) BY EXCISION OF ELLIPTIC AREAS OF MUCOSA AND SKIN, FOLLOWED BY SUTURING

DURET'S TECHNIC

Description.—This method carries out, on a larger scale and by operative means, the principle underlying linear cauterization. Elliptic or diamond-shaped portions of rectal mucosa and adjacent skin (two or six in number, according to the laxity of the parts), axially placed, are excised, and the resulting beds sutured – thereby constricting the anorectal outlet.

Operation.—The operation is described by Duret as rectorrhaphy. Anteriorly and posteriorly – and laterally, as well, if needed – diamond-shaped or elliptic areas, chiefly of mucosa, and limitedly of skin, are excised. Their long axes will correspond with that of the anorectal canal – and the amount of skin to be included, at the anal orifice, will depend upon the degree of laxity of the anal orifice itself, and the ellipses, or diamonds, will extend from the apex to the base of the prolapse. The beds of these raw areas are the muscular walls of the anorectum (Fig. 4301). These muscular beds are so sutured, by buried chromic catgut sutures, as to throw each one of them into a series of axial furrows. Finally, the margins of each elliptic wound are brought together by fine catgut suturing. The effect of this technic is to narrow the ampullary enlargement of the rectum into a tubular type of rectum, of smaller caliber, thereby supplying a support and barrier against the outward escape of the rectal mucosa through the anorectum.

The elliptic or rhomboidal islands excised consist chiefly of mucosa and

limitedly of skin, down to the submucous and subcutaneous connective-tissue planes.

At the end of the operation the sutured sites are lubricated and pushed back within the anorectal canal. A rectal tube is temporarily employed.

OPERATION FOR PROLAPSE OF THE RECTAL MUCOSA (PARTIAL RECTAL PROLAPSE) BY EXCISION OF THE MUCOSA, FOLLOWED BY SUTURING

Description.—This consists of the excision of the prolapsing portion of the rectal mucous membrane, followed by restoration of its continuity by suturing the lower limit of the divided mucosa, above, to the upper limit of the divided mucosa, below.

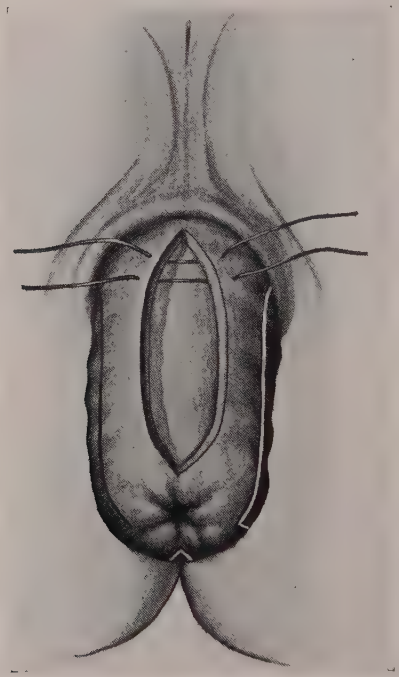


Fig. 4301.—Operation for Prolapse of the Rectal Mucosa, by Excision of Elliptic Areas of Mucosa and Skin, Followed by Suturing – Duret's Technic.

Operation.—This procedure is, for all practical intents and purposes, the same as the Whitehead operation for complete circumferential hemorrhoids (v. p. 158). The operative technic is the same, and will not be separately given. Indeed, the operation is simpler, as the mucosa has been rolled out to, and before, the Operator – there is no active tension against him as he makes the mucosal excision – and, especially, is there no tension upon the sutures following the excision.

In another technic (Fig. 4301) elliptic areas of mucosal tissue are excised. The subsequent suturing of the margins of these areas constricts the parts, thus tending to restrain prolapse.

OPERATION FOR COMPLETE PROLAPSE OF THE RECTUM IN CHILDREN

RITTER'S MODIFICATION OF SICK'S OPERATION

Description.—The lower rectum is mobilized, through a posterior perineal wound, which is so packed with strips of gauze as to promote subsequent extensive adhesions _ and upon these retention of the rectum in position is dependent. The operation has been employed in complete prolapse of the first and second degrees, hardly in the third, and not in incomplete prolapse.

Operation.—A straight incision is made in the posterior midperineal line, from the tip of the coccyx to the margin of the sphincter. Through this incision, by means of blunt dissection, accomplished by finger or curved blunt dissector, the rectum is mobilized up as high as the promontory of the sacrum. Not only is the posterior aspect of the rectum freed, but the entire circumference of the rectum is mobilized, by tunnelling through the connective-

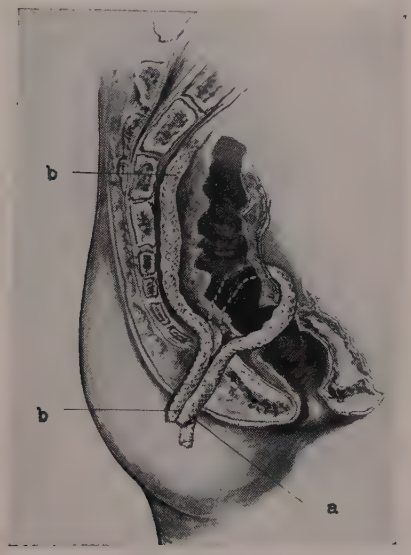


Fig. 4302.—Ritter's Modification of Sick's Operation for Complete Prolapsus Recti, in Children: _ a, Ring of gauze packing surrounding the detached rectum; _ b, b, string of gauze packed posteriorly to the mobilized rectum.

tissue plane. One strip of broadly twisted gauze is then carried entirely around the rectum, through the posterior perineal wound, and its ends anchored to the skin in the neighborhood of the coccyx. Another piece of twisted gauze is carried up posteriorly, between the rectum and sacrum, from the perineal wound _ through which both pieces of gauze emerge (Fig. 4302).

The patient is put to bed, and the bowels kept constipated until the fifth day _ at which time the gauze is removed.

OPERATION FOR COMPLETE PROLAPSE OF THE LOWER RECTUM BY WEDGE-SHAPED EXCISION

DIEFFENBACH-ROBERTS TECHNIC

Description.—This method has been successfully used where the prolapse has been limited to the lower portion of the rectum. The wedge-shaped

portion of tissue is removed from the posterior aspect of the anorectal wall, and consists of all the walls of the rectum, the sphincters, and perineal tissues.

Operation.—The patient is placed in the lithotomy position, and the prolapse of the rectum reduced and the sphincters dilated. A small, crescentic incision, with backward convexity, is made in the posterior perineum, crossing the median line. Through this incision the finger is introduced, or a curved blunt dissector, and the rectum freed from the perirectal tissue (Fig. 4303). A knife is now introduced into the rectum and a V-shaped piece of the entire posterior rectal wall and corresponding portion of internal and external sphincters is excised _ the apex of the incision being about 5 cm. (2 inches) up the posterior rectal wall _ and its base being represented by the previously made crescentic incision in the midline, posterior to the anus. The two lateral cuts, embracing this wedge, pass down into the already freed connective-tissue plane. The rectoperineal wedge of tissue is then removed. Following the excision the parts are sutured with great care _ to coapt the divided tissues and to eliminate all dead space. The perineal tissues and sphincters

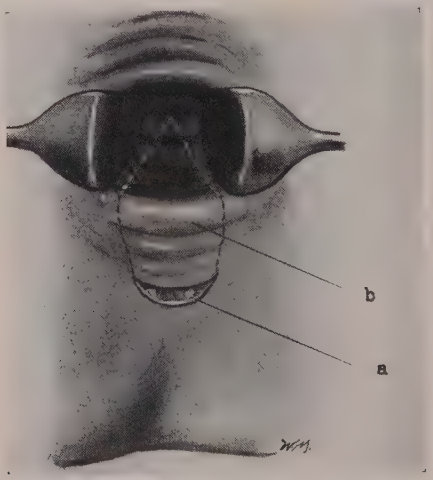


Fig. 4303.—Dieffenbach-Roberts Operation for Prolapsus Recti: _ a, Postanal incision into the perirectal tissue; _ b, wedge-shaped piece removed from the posterior anorectal wall, continuous with the perineal incision.

are brought together by separate buried fine chromic catgut sutures _ and then the inner rectal wall is accurately sutured with another tier of fine chromic catgut _ after which the perineal skin is closed by silk or silkworm filament. A rectal tube is introduced _ and the bowels kept bound for several days.

The success of the operation will depend, to an unusual degree, upon primary union _ for if union fail, the condition is apt to be made actually worse _ for even additional room is supplied for prolapse.

OPERATION FOR COMPLETE PROLAPSE OF THE RECTUM BY EXCISION OF THE MUCOSA, FOLLOWED BY SUTURING

DELORME'S TECHNIC

Description.—A band of mucosa, corresponding, in width, with the length of the prolapse, is excised from the prolapsed portion of the rectum _ after which the free margins of the mucosa, above and below, are sutured together. Delorme reports thus removing as much as 80 cm. (31½ inches) of the mucosa _



Fig 4304.—Delorme's Operation for Prolapsus Recti – I: – a, Knife making circular incision of the everted anal mucosa; – b, dotted line, marking lower level of circular division of the rectal mucosa; – c, c, tractors of the mucosa, which is being freed by combined eversion, blunt dissection, and sharp dissection.

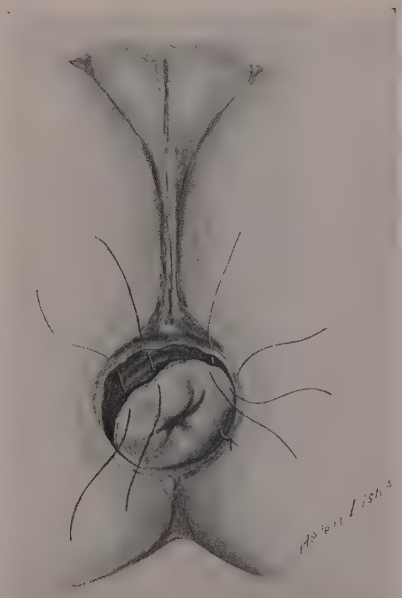


Fig. 4305.—The Same - II; – Sutures are uniting the anal and rectal mucosæ – thus folding or tucking in the denuded segment included between the two circular incisions. This will be made plainer by referring to Fig. 4304, of the prolapsed rectum.

as incredible as the removal of such extreme lengths may seem. For shorter, very much shorter, lengths the operation seems feasible and useful.

Operation.—The mucosa is circularly incised at the upper and lower limits of the prolapsed portion of the rectum _ the incision passing only into the plane of the submucosal connective tissue _ after which the upper limit of the separated part of the mucosa is clamped with forceps and everted _ and, thus held, the cuff of mucosa is drawn downward, as one removes the finger of a glove by reversing it _ touching, here and there, with a knife or scissors, the connective tissue which binds it to the muscularis, wherever it is necessary to free it (Fig. 4304), until finally the entire mucosal cuff slips off, with the raw surface outermost. The protruding portion of the rectum is thus left entirely denuded of mucosa between the limits of the upper and lower circular incisions. The upper and lower limits of retained mucosa are then sutured together with chromic catgut by interrupted sutures placed comparatively closely together (Fig. 4305). As the lower circular incision of the mucosa is at the mucocutaneous border when the sutures are tied _ after tying any bleeding vessels and mechanically replacing the denuded rectum _ the lower limit of the protruded rectum is held up and in contact with the mucocutaneous circumference, at first, by the suturing and, subsequently, by the narrowing and by adhesions. The patient is confined to bed during convalescence _ and wears, for a time, a rectal tube.

OPERATION FOR COMPLETE PROLAPSE OF THE RECTUM BY EXCISION OF THE PROLAPSED SEGMENT, FOLLOWED BY SUTURING

MIKULICZ'S TECHNIC

Description.—The prolapsed portion, drawn down as far as possible, is totally excised, step by step, and, *pari passu*, sutured _ constituting an excision of the double barreled segment prolapsed, and a reconstruction of the continuity of the bowel.

Operation.—The patient is placed in the lithotomy position, but with the buttocks elevated, so that any hernia of the small intestine, into the peritoneal reflection of the prolapsed segment, will gravitate back into the general cavity, and not be in the way of being cut. Having cleansed the parts, the prolapsed rectum is grasped with a clamp and drawn down as far as it will come. Before proceeding one should, by digital examination, try to be certain no coils of small intestine are in the field, and, if detected, effort should be made to press them back into the cavity. It is well to control the intestinal flow from above by a gauze packing, held by ligature, carried up the lumen of the double tube. A transverse incision of limited length is now made, just in front of the anal orifice, first through the mucosa of the anterior aspect of the prolapsed bowel _ and then carefully carried through all the coats, until the peritoneal cavity is reached, which should be entered guardedly, so as not to wound a coil of small intestine, if one be present. Any bleeding vessels encountered are tied with fine catgut. As soon as this stage of the operation has been reached, a continuous overlap suture, of chromic catgut, immediately above the cut margin, but not including the margin, is passed through all the coats of the outer barrel of rectum, but only through the serosa of the inner barrel (Fig. 4306). As soon as one segment of this section has been made and sutured, another segment is incised and sutured _ until the entire circumference of the outer barrel has been entirely divided and sutured _ and, at the same time, the peritoneal cavity has been shut off by the suturing. The intussuscepted portion of the rectum (the inner barrel) is now completely divided, transversely, just distal to the suturing _ after which the two concentric free ends



Fig. 4306.—MIKULICZ'S OPERATION FOR PROLAPSUS RECTI – I; – An overlap suture is carried through the entire thickness of the outer intestinal tube and the peritoneum of both outer and inner tubes, just above the site at which the transverse division of both tubes is to be made – the suturing and division progressing *pari passu*. The peritoneum of the inner tube is seen between the lips of the cut.

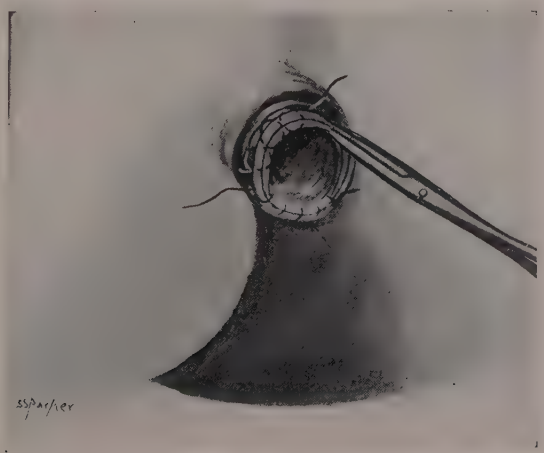


Fig. 4307.—The Same – II; – The two concentric outer and inner intestinal tubes are sutured together marginally, along their free borders, through all their coats.

of both inner and outer barrels of rectum are sutured together by a continuous marginal suture of chromic catgut, including all the coats of each barrel – as shown in Fig. 4307. (An alternate way of suturing, omitting the first tier

above mentioned, is, after cutting through the outer barrel and entering the peritoneal cavity, to then at once circularly, step by step, divide the peritoneal coat, only of the inner barrel, and at once suture this to the peritoneal coat of the outer barrel _ and then, when this is completed, completely divide the inner barrel, and at once suture together all the coats of inner and outer barrels. The final result is the same _ but the method first described is probably better, if one be sure that no coil of small intestine will be penetrated by the first tier of sutures.) Total excision of the prolapsed part of the rectum, followed by end-to-end rectorectostomy, is thus accomplished. The final or marginal tier of sutures may be of interrupted stitches _ and the ends of this suturing, in either event, should be clamped and held until the entire division and suturing are completed _ to prevent the divided ends of the rectum from drawing back into the cavity, which might cause awkwardness. Finally, the line of suturing is dusted with aristol and painted with several layers of flexible collodion _ and the part returned to its natural position. A rectal tube is kept in position for a few days, and the bowels kept constipated for seven or eight days _ the patient being kept under opium.

OPERATION FOR COMPLETE PROLAPSE OF THE RECTUM BY EXCISION OF THE PROLAPSED SEGMENT, FOLLOWED BY SUTURING

CUNNINGHAM'S TECHNIC

Description.—The concentric, double-barreled segment of prolapsed bowel is drawn well downward _ after which the outer barrel is circularly divided and clamped, and then the inner barrel is unrolled, clamped, and divided (excised) _ and the free margins of the remaining segments united by end-to-end suturing.

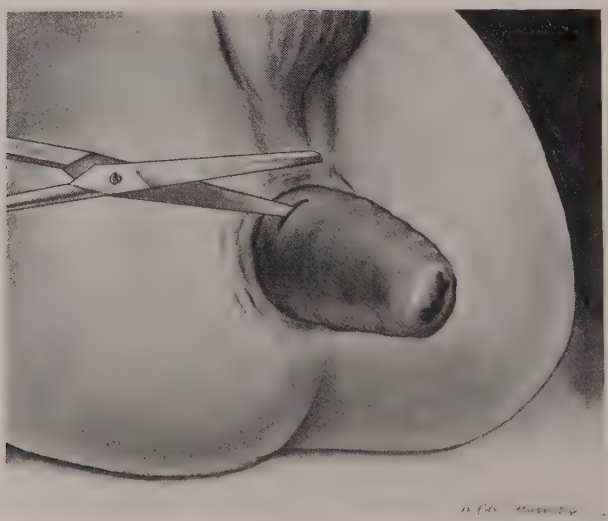


Fig. 4308.—Cunningham's Operation for Prolapsus Recti _ I; _ Dividing the wall of the prolapsed intussuscipiens.

Operation.—The patient, prepared, purged and irrigated, with the rectum in normal site, is brought over the end of the table, in the lithotomy position. The prolapsed portion of rectum, seized with gauze, is drawn well outward.

At a distance of 2 cm. ($\frac{3}{4}$ inch) from the anal orifice, and parallel with it, the outer barrel of rectum is circularly incised through all of its coats – entering

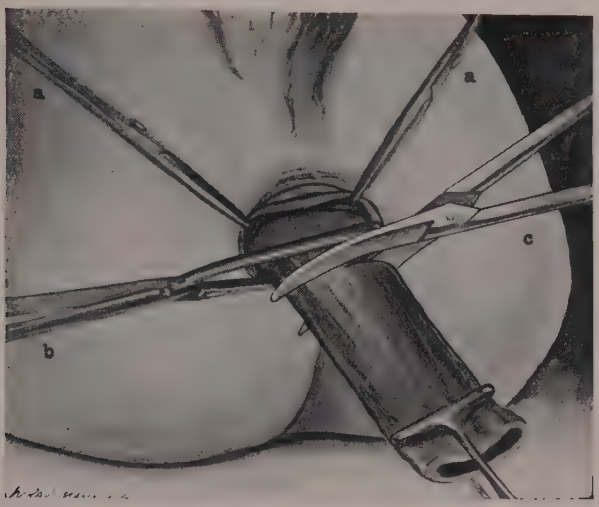


Fig. 4309.—The Same – II: – a, a, Tractors holding the divided intussuscipiens; – b, forceps compressing and holding the intussusceptum after being unrolled; – c, scissors dividing the same.

the peritoneal cavity carefully and, when once within it, examining, digitally, to see that no coils of small intestine are in the way. The circular incision, after once entering the peritoneal fold, is best made with blunt-pointed scissors

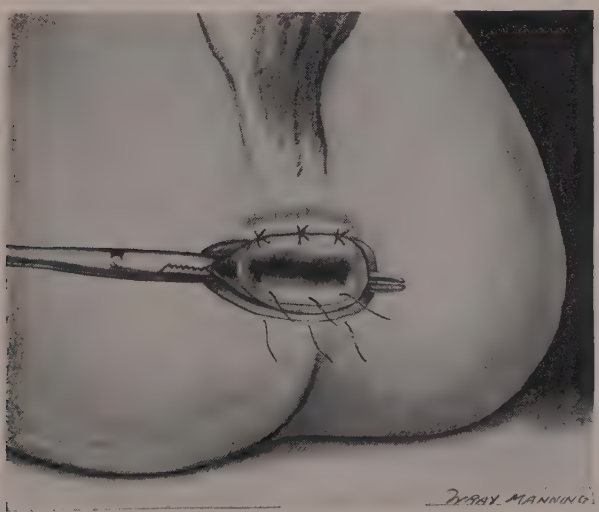


Fig. 4310.—The Same – III; – Forceps are still holding the divided intussusceptum – while the contiguous severed edges of the intussuscipiens and intussusceptum are being sutured together prior to returning them to the pelvic cavity.

(Fig. 4308). Before the circular incision is completed the free margins of the incised rectum which is nearer the anal orifice is seized with two forceps (Fig. 4309, a, a). The outer, circularly incised barrel of the prolapsed segment is

then rolled downward, cuff fashion, with mucosa inward, until the segment is one continuous straight stretch of double the length and held under tension, by a clamp _ as shown in the last illustration. All bleeding vessels in the short segment next the anal orifice are ligated with fine catgut. And the long, terminally clamped segment is then transversely clamped as high as possible _ after which it is transversely divided, with knife or scissors, about 1.2 cm. ($\frac{1}{2}$ inch) distal to the transverse clamp. A careful examination of the mesentery of this portion of the rectum is then made, and all bleeding vessels there found are ligated with fine catgut _ and this is an especially important part of the technic, to prevent hemorrhage which otherwise sometimes takes place from this source, after the bowel is returned within the pelvis. The concentric margins of the two barrels of rectum are then sutured together, through all their coats, by a continuous buttonhole, whipping-over stitch, of chromic catgut including 1.2 cm. ($\frac{1}{4}$ inch) of each bowel margin (interrupted sutures are shown in the illustration, Fig. 4310) _ until the ends of the transversely holding clamp are reached, when this clamp is withdrawn, so that these regions may be included in the suturing.

The sutured bowel is returned into its place _ a rectal tube introduced, and retained one week _ and the patient kept constipated under opium for about ten days.

OPERATION FOR COMPLETE PROLAPSUS RECTI IN THE MALE BY PLICATION OF THE RECTUM AND MYORRHAPHY OF THE LEVATORES ANI

Description.—The anterior aspect of the rectum is here exposed instead of its posterior aspect, as usual. This is done by splitting the raphé of the levatores ani in front of the rectum _ after which the securing and sustaining of the prolapsed rectum are accomplished by the axial and transverse plication of the rectum _ and by the shortening of the sling formed by the levatores ani _ by special method of suturing.

Operation.—The patient resting in the lithotomy position, a curved incision, with anterior convexity, is carried across the perineum, passing about 1.5 cm. ($\frac{5}{8}$ inch) in front of the anus, and extending from one ischial tuberosity to the other. A median perineal incision may be added, anteriorly, if necessary. The more anterior fibers of the external sphincter, constituting the anobulbar raphé, will be divided by this curved incision. The ischiorectal fatty connective tissue is also incised _ until the lower aspect of the levatores ani are encountered. In displacing the anus backward, by retraction, and the bulbar structures forward, the median inferior borders of the levatores ani are made to stand out prominently like two cords _ passing forward and forming the urogenital diaphragm. The anterior aspect of the rectum is exposed and freed by dividing this raphé of the levatores ani, exactly in the median line, holding a straight, narrow-bladed knife, or bistoury at a right angle to the surface, and avoiding injury to both the bulb and prostate, in front, and the rectum, behind. Having made this incision the rest of the freeing of the prerectal space is accomplished by blunt dissection.

The plication, or axial infolding of the anterior rectal wall _ that is, the pleating of it upon itself longitudinally (Fig. 4311) _ is accomplished by a series of transverse sutures of chromic catgut, passing through the outer coats of the rectum, but not penetrating its lumen. The number of these used (except that it must be an even number), and the width of anterior rectal wall included by them, will depend upon the grade of the case and the amount of infolding which may be indicated. When these plaiting sutures have all been placed, they are then tied _ but the ends of the sutures are left long. These

first transverse tyings will cause the anterior aspect of the rectum to be infolded in axial or longitudinal pleats. One limb of each tied suture is then taken and longitudinally tied with its neighbor, thereby transversely plaiting the already longitudinally plaited anterior rectal wall.

The suturing of the levatores ani is accomplished in a special manner, and by means of a Reverdin needle. It is the inner aspects of the levatores which are sutured together, and not their borders _ and, at the same time, the anterior surface of the rectum is brought into contact with the muscles. The method of accomplishing this is shown in Fig. 4312. Each levator is everted,

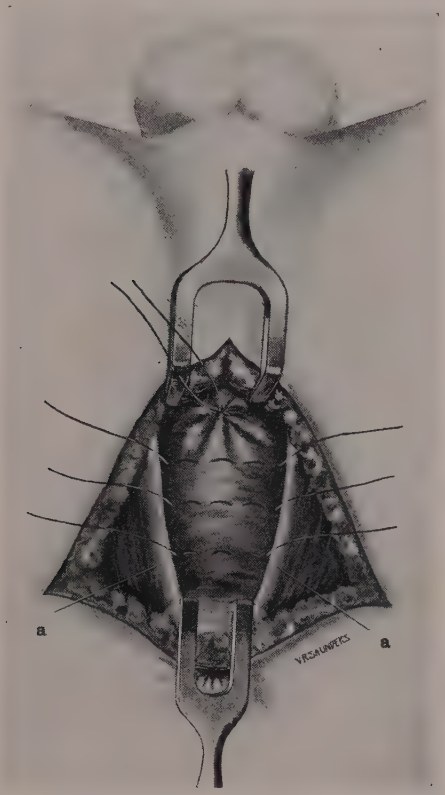


Fig. 4311.—Plication of the Rectum and Myorrhaphy of the Levatores Ani for Prolapsus Recti _ I; _ The rectum, exposed through a combination transversely curved and straight median perineal incisions, is so sutured as to be involuted within itself, in pleats, when the sutures are tied _ as shown by the first (upper) tied suture: _ a, a, Levatores ani.

after which the needle passes first in, then out of its substance, both punctures being upon its inner aspect, and then draws back with it, in the withdrawal of the needle, a limb of the already tied suture, through the inner aspect of each muscle. When these sutures are tied, the inner walls of the levatores are not only approximated to each other but also to the anterior wall of the rectum _ thereby catching a shorter and, therefore, a more advantageous, uplifting hold on the rectum. The free median borders of the levatores are separately sutured with buried chromic catgut stitches. Finally, the skin and connective tissue are brought together as shown in Fig. 4313. A rectal tube is introduced, and the bowels kept constipated under opium.



Fig. 4312.—The Same – II; – Suturing of the perineal sling. The deep and marginal sutures are shown.



Fig. 4313.—The Same – III; – Closure of the perineal wound.

OPERATION FOR COMPLETE PROLAPSUS RECTI, BY PROCTORRHAPHY AND PROTOPEXY, AFTER EXPOSING THE RECTUM THROUGH A POSTERIOR MEDIAN PERINEAL SECTION AND EXCISING THE COCCYX

Description.—This represents a simpler type of extraperitoneal posterior proctorrhaphy and proctopexy, such as might be applicable to one of the less grave grades of prolapse.

Operation.—The skin, connective tissue, and pelvic diaphragm are medially split, in the posterior perineal line, from the tip of the coccyx to within 1.2 cm. ($\frac{1}{2}$ inch) of the anus, through the anococcygeal ligament – the incision of the deeper parts becoming Y-shaped posteriorly, where it hugs both sides of the



Fig. 4314.—Proctorrhaphy and Proctopexy, for Complete Prolapsus Recti – After Exposing the Rectum Through a Posterior Median Perineal Section and Excising the Coccyx: – a, Proctorrhaphy sutures infolding part of the posterior rectal wall; – b, proctopexy sutures anchoring therectum to the sacrosciatic ligaments.

coccyx, which is then excised. Chromic catgut sutures, as many as indicated, are then passed transversely through the outer walls of the rectum, not penetrating its lumen, and taking in as great a width of the posterior wall of the rectum as it is desired to infold (Fig. 4314, **a**). These sutures are only passed after the prolapse of the rectum has been fully or overcorrected. Chromic catgut sutures are then passed through the outer walls of the posterior surface of the rectum, and through the sacrosciatic ligaments, on each side (Fig. 4314, **b**). The object of the transverse sutures is to narrow the rectum – and that of the rectosacrococcygeal ones, to suspend it, or to anchor it in its normal position. Finally, the margins of the pelvic diaphragm are brought together by buried sutures – and the skin and connective tissue wound closed.

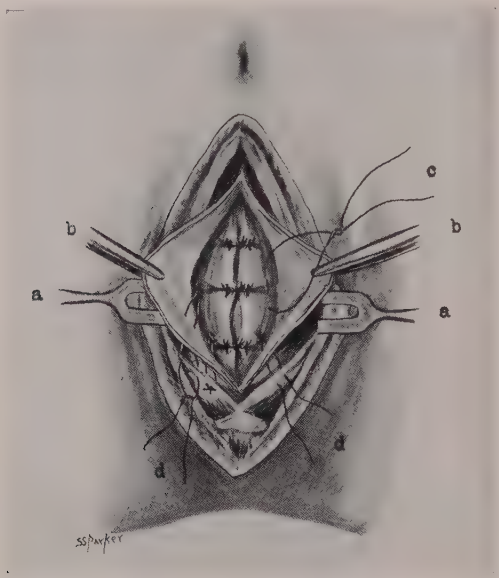


Fig. 4315.—Rectopexy by Plication – After Exposing the Rectum Through a Median Perineal Section, and Excising the Coccyx: – a, a, Retracting the skin and fascia; – b, b, medially split levatores, retracted; – c, laterally placed, infolding sutures of rectum tied together; – d, d, ends of the tied rectal sutures passed through the levatores ani and tied again – to be followed by suturing the edges of the levatores together.

The after-treatment is as in other operations of this general nature, already described.

A somewhat different technic is shown in Fig. 4315.

OPERATION FOR COMPLETE PROLAPSUS RECTI, BY COMBINED AXIAL AND TRANSVERSE RECTORRHAPHY, AND RECTOPEXY, FOLLOWING EXCISION OF THE COCCYX

LANGE-VERNEUIL METHODS

Description.—This technic represents a combination of the methods of Lange (transverse plaiting of the posterior rectal wall, after excising the coccyx, by axial suturing), and of Verneuil (axial plaiting by transverse suturing plus rectopexy).

Operation.—A posterior median incision is made from over the lower aspect of the sacrum, nearly to the anus. The anococcygeal ligament is split, and at the upper end of the cut (the deep cut) the dissection becomes Y-shaped, to hug both sides of the coccyx, which is excised at the sacrococcygeal junction, after freeing the laterally attached musculofibrous structures. Thus are separated, in the median line, the fibers of the anococcygeal ligament – from the sides of the coccyx, the prolonged anococcygeal attachments, the levatores ani, and the glutei maximi.

The posterior wall of the rectum is then included in a continuous, non-penetrating, chromic catgut suture, placed in the manner shown in Fig. 4316 – the distance apart of the parallel limbs of the suture, as well as the total length of the entire suture, depending upon the extent of the transverse plaiting desired. When this stitch, which does not penetrate the mucosa, is tied, the transverse folds shown in this illustration are produced – constituting the Lange feature. The one median, longitudinal plaiting, of the Verneuil modi-



Fig. 4316.—Lange-Verneuil's Operation for Prolapsus Recti – I: – a, Site of excised coccyx; – b, b, borders of glutei maximi, separated from the coccyx; – c, c, and d, d, attachments of the anococcygeal ligament and levatores ani similarly separated; – e, draw-string suture through the rectal muscularis, infolding transverse ridges, placed ready for tying. (Figs. 4316–4318 modified from Kelly and Noble.)



Fig 4317.—The Same – II; – The axial suture, a, has been tightened and tied, causing parallel, transverse infoldings – thus shortening the prolonged rectum. The transverse sutures are now placed

fication, is accomplished by a series of transversely running, non-penetrating sutures of chromic catgut (Fig. 4317, b, b). When these are tied, the result is as shown in Fig. 4318, illustrating the resulting narrowing of the rectum.

Finally, the rectum is returned to the pelvis and placed as high as possible – and, while in this position, is anchored, on each side, by chromic catgut sutures which do not penetrate its lumen, to the resistant sacrococcygeal structures, before they are turned back into place and sutured. The muscular and



Fig. 4318.—The Same – III; – The transverse sutures are now tied, burying in the longitudinal, puckering suture – thus also narrowing the prolapsed rectum.

fibrous structures severed in the steps of the exposure are now repaired, in reverse order, by buried sutures of chromic catgut and the skin wound closed. The after-treatment is as in other operations of this nature.

RECTOPEXY BY SACRAL SUSPENSION FOR COMPLETE PROLAPSUS RECTI

TUTTLE'S OPERATION

Description.—Having inverted the rectum through a posterior semilunar incision crossing the posterior perineum transversely, suspension sutures are placed in the posterior rectal wall, which are then conducted through the parasacral tissues, thereby drawing the rectum up against the sacrum, which has been cureted to receive it. These sutures are tied over the cutaneous aspect of the sacrum, a gauze pad intervening – until union of the cureted rectum to the cureted sacrum holds it permanently in position. This is one of the best methods for securing the substantial anchorage of the prolapsed rectum.

Operation.—The patient comes to the table with bowels purged, and the part cleansed and enveloped in antiseptic dressing – and is placed in a marked Sims left semiprone position, with buttocks elevated by supports, and the thighs drawn well up upon the abdomen. An Assistant first draws the prolapse well downward and steadies it in this position – while a semilunar incision, with backward convexity, about 5 cm. (2 inches) long, is made transversely across the posterior perineum, crossing the median line half-way between the anus and the coccyx (Fig. 4319). The incision is deepened by blunt dissection, digitally and by blunt dissector, through the tissues of the

retrorectal region, until the hollow of the sacrum is reached – and continuing the blunt dissection, the rectum is freed from the coccyx and sacrum, medially,

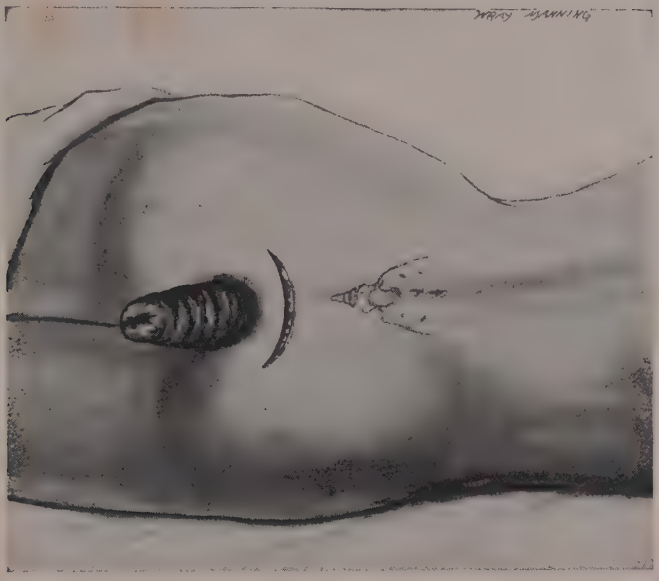


Fig. 4319.—Tuttle's Rectopexy for Prolapsus Recti – I; – Crescentic incision, midway between the coccyx and anus. (It is preferable to place the patient in a marked Sims position.)

from the tip of the former, up to the reflection of the mesorectum – and, laterally, up to the attachment of the lateral ligaments, but especially pre-

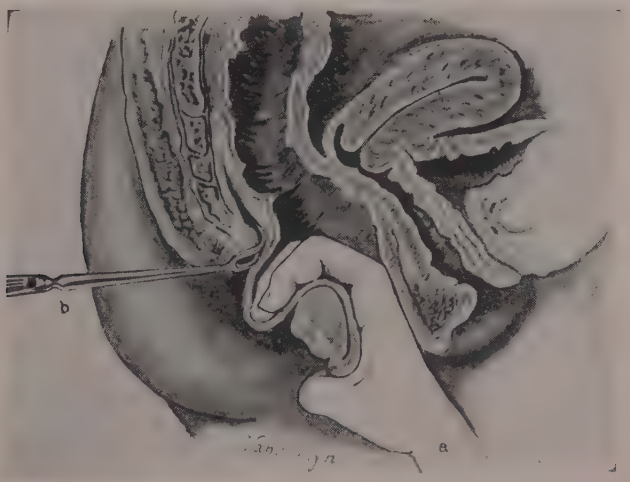


Fig. 4320.—The Same – II: – a, Cross-section, showing the manual method of invaginating the posterior wall of the prolapsed rectum through the posterior incision; – b, retractor displacing the coccyx backward, and displaying the plane of separation of the posterior wall of the rectum by blunt dissection. (Redrawn from Kelly and Noble.)

serving these ligaments. The hollow of the sacrum (its anterior surface) is now carefully cureted free of the fatty areolar tissue which covers it.

The Assistant, with two fingers within the rectum, now inverts (or everts) the rectum through the semilunar incision (Fig. 4320) until the Surgeon can seize the protruded bowel and aid in its outward displacement — until almost as much of it is displaced through the posterior wound, as was prolapsed through the anus. The posterior surface of the rectum is gently cureted, to promote adhesions with the cureted sacrum. A series of sutures of silkworm filament (or, according to Tuttle, of silver wire) are now carried transversely through the posterior rectal wall, carefully avoiding penetration into its lumen. They penetrate the muscular layer of the bowel, including as great a width as possible, and are placed about 1.2 cm. ($\frac{1}{2}$ inch) apart — being left 15.3 cm. (6 inches) or more, in length, at each end. By means of a Peaslee

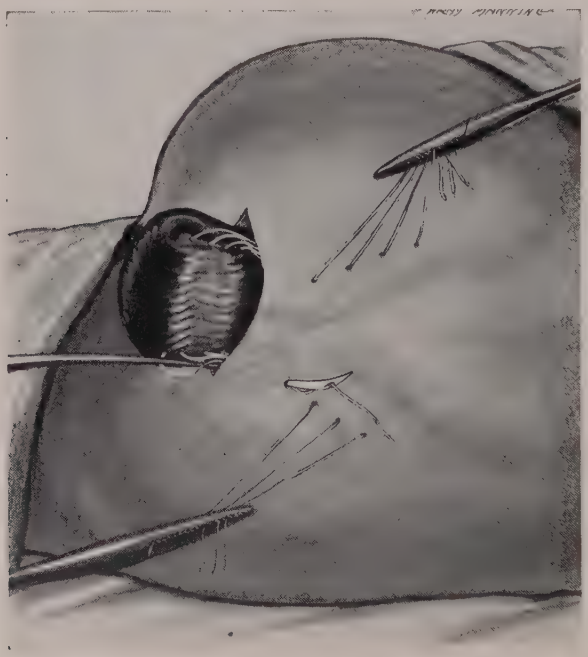


Fig. 4321.—The Same — III; — The bowel has been invaginated, by two fingers within the rectum, and then everted into the postanal wound, so that a loop protrudes. Three or four silkworm sutures are passed transversely through the muscularis of the distal portion of the protruding loop of the rectum — and are then carried by a Reverdin needle, or Peaslee needle, out through the tissue of the parasacral region, where they are grasped by forceps.

needle (or, better, a Reverdin needle) the free ends of these sutures, on each side, beginning with the uppermost pair, are carried through the wound up to the highest site of separation between rectum and sacrum, and there made to penetrate the soft parts immediately overlying the lateral aspects (borders) of the sacrum, emerging upon the skin of the parasacral and paracoccygeal region — each pair of sutures emerging a little lower than the preceding pair (Fig. 4321). These sutures thus pass obliquely upward and backward, from the rectum, through the skin — so that when they are tightened they will draw the rectum both upward and backward, against the prepared sacrum — thus suspending the organ against the end of the spinal column. Finally, these suspending sutures are tied over a small gauze pad (Fig. 4322) and the semilunar perineal wound closed by buried catgut and superficial silkworm filament. The suspending su-

tures must be carefully and tautly tied over a small, compactly made (unyielding) gauze pad _ for it is readily conceivable that if they be tied over anything like fluff gauze, or a carelessly made loose pad, that there might ultimately occur so much slack in the sutures as to fail to hold the rectum snugly in contact with the sacrum, and upward at the required height _ which might modify the results of the entire operation. Before the final tying of these suspending sutures all débris and blood-clots should be removed from the space between the rectum and sacrococcygeal structures _ and all bleeding absolutely arrested.

In cases where the sphincters are much relaxed, a kangaroo tendon may be carried, subcutaneously, around the anus, on the plane of the upper margin of the external sphincter, and tied over a finger introduced into the rectum during the tying, that the constriction of the anal outlet be not too much cur-

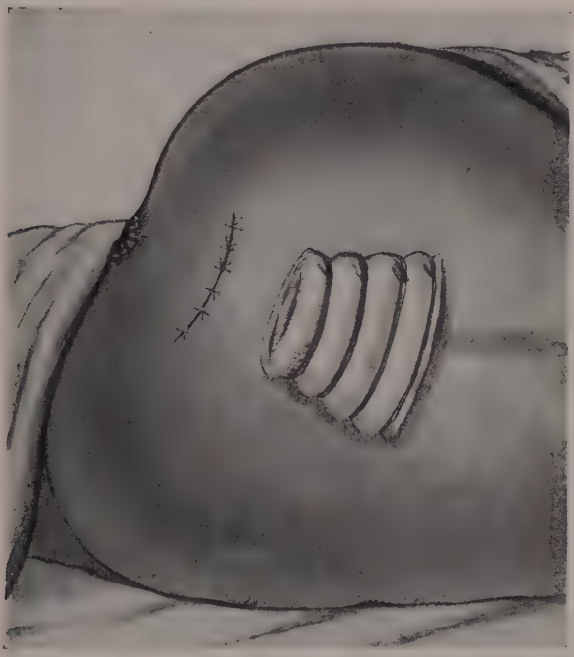


Fig. 4322.—The Same _ IV; _ The anchoring sutures are shown tied over a graduated gauze pad (here shown too bulky) _ the wound of exposure is closed _ and the anus is still closed by the suture temporarily used for control. (Modified from Kelly and Noble.)

tailed _ as is done in the Platt technic _ in order to narrow the anorectal outlet, by causing contracture of the parts, and thus reinforcing the main technic.

The patient remains in bed for three weeks, using the bed-pan, in the horizontal attitude during this time. The anchoring sutures are removed at the end of ten to fourteen days.

POSTERIOR RECTOPLASTY FOR COMPLETE PROLAPSUS RECTI

GANT'S OPERATION

Description.—This is an application of the principle of shortening a definite length of tubing (especially upon one aspect) by suturing transversely an incision which has been made longitudinally.

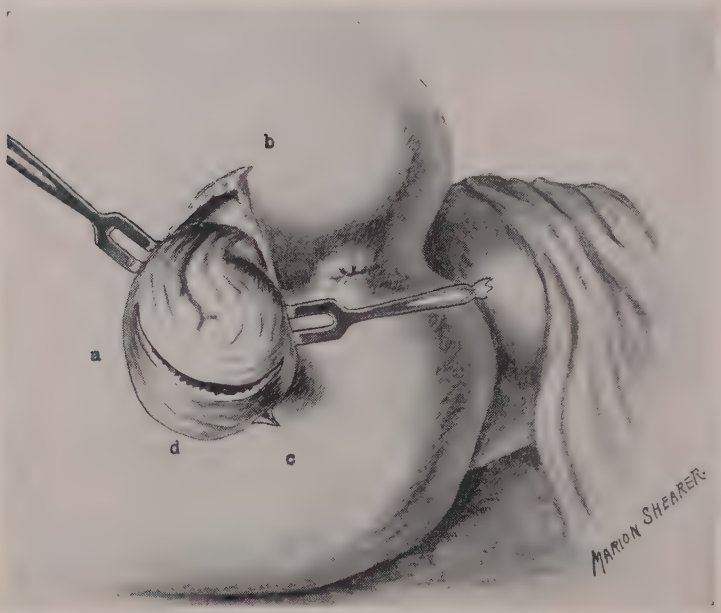


Fig. 4323.—GANT'S OPERATION FOR PROLAPSUS RECTI — I: — a, Coccyx; — b, c, transverse incision just below the coccyx; — d, loop of prolapsed rectum brought through the wound and incised axially

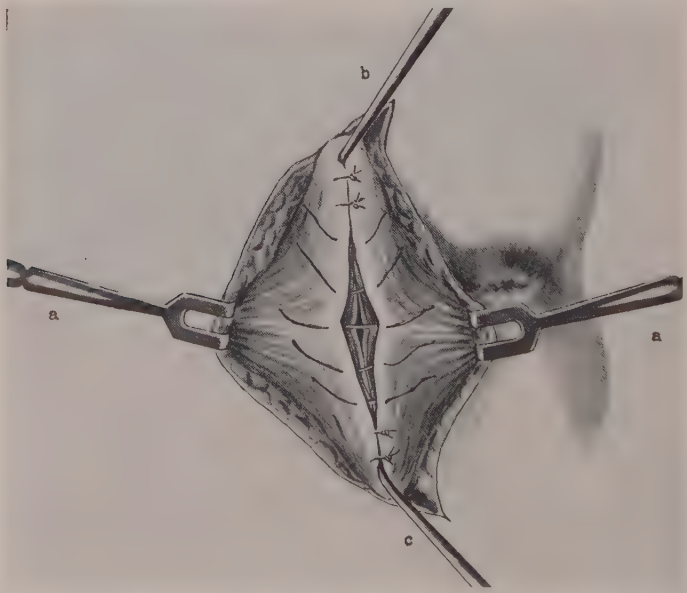


Fig. 4324.—GANT'S OPERATION FOR PROLAPSUS RECTI — II: — a, a, Tractors separating the edges of the skin wound laterally; — b, b, hook-retractors separating the lips of the rectal incision, caudad and cephalad. The rectal incision is closed by interrupted non-penetrating sutures.

Operation.—A transversely curvilinear incision, about 6.8 cm. (1½ inches) long, is made across the median posterior perineal line, crossing just anteriorly

to the tip of the coccyx – after which the posterior aspect of the rectum is freed and brought into the wound in exactly the same manner as described in the steps of Tuttle's operation (p. 216).

An axial or longitudinal incision is then made down the posterior aspect of the rectum, passing through all the coats of the bowel, into the lumen, and extending from 5 to 10 cm. (2–4 inches) in length, according to the amount of shortening desired (Fig. 4323). This wound, made longitudinally, is now stretched, by two wound-hooks, laterally, and sutured transversely – by interrupted silk, or chromic catgut sutures, of the Lembert type (Fig. 4324).

By this procedure the rectum is shortened by several inches, especially upon its posterior wall.

LYNCH'S OPERATION FOR PROLAPSUS RECTI

Through the courtesy of Dr. Jerome M. Lynch, of New York, the preliminary description of an operative technic devised for prolapsed rectum (and already carried out in two cases) is here given in the words of its originator:

"There is no operation, so far as I know, that is wholly satisfactory for this condition. I will not discuss in this paper the multitudinous views held by various authorities as to the cause of prolapse, as they are too well known to need description. The number of operations that have been suggested is sufficient evidence to prove that no special one is entirely acceptable.

"It would be difficult to imagine a prolapse associated with a very short sigmoid, therefore we must assume that a long sigmoid is the first requisite to bring about this condition. I do not deny, as has been pointed out by Quénu and Moschowitz, that a deep culdesac is an etiologic factor; but there are the other anatomic factors besides a long sigmoid that enter into the mechanism of prolapse. The loose connective tissue at the peritoneal reflection, the lateral ligaments, and the levator muscle. As has been pointed out by Todd, the lateral ligaments are the chief supports of the rectum. And not, as has been supposed, the levator muscle. Anyone familiar with the operation for extirpation of the rectum can substantiate the fact that mobilization of the bowel even after the severing of the levator is impossible until the lateral ligaments and the loose bands of connective tissue have been severed. Even then one has to cut the peritoneum of the sigmoid before bringing the bowel outside of the anal canal.

"Todd has also demonstrated that the blood-vessels and nerves in the lateral ligaments are convoluted; and, when stretched, are about twice as long as the lateral ligaments, so that as the ligaments are stretched the convolutions gradually straighten out, permitting the bowel to come down, without strain on the blood-vessels and nerves. Any operation to be satisfactory should be anatomically correct. It would seem, therefore, that resection of the sigmoid, with shortening of the lateral ligaments, should be the operation of choice in prolapse of the rectum. I have not combined these two procedures in the operations that I have so far performed. But in one case of long-standing prolapse that had previously had many operations, the one I am about to describe proved very satisfactory. This woman not alone had a prolapse, but such marked loss of sphincteric tone that it seemed even though the rectum was replaced, there must still remain incontinence. Much to my surprise, this patient has regained complete control. So complete, in fact, that she can retain an enema.

"The operation is as follows: An incision is made in the posterior vaginal wall, from the cervix to the transversus perinei muscles. The vaginal wall is dissected free from the rectum, and the lateral ligaments exposed. By

means of four interrupted chromic catgut sutures, on either side, the lateral ligaments are shortened and the bowel immobilized in its natural position."

The same principle is applied, in the case of the male, by an intraperitoneal shortening of the lateral ligaments of the rectum, exposed through an intra-abdominal approach.

EXCISIONS OF THE RECTUM, IN GENERAL

The Anorectosigmoidal Tract.—Various divisions of this tract have been given in its description from time to time. The Anatomy of these parts is summarized below (v. p. 224). The subdivisions of the parts, as employed in the operations about to be described, are as follows:

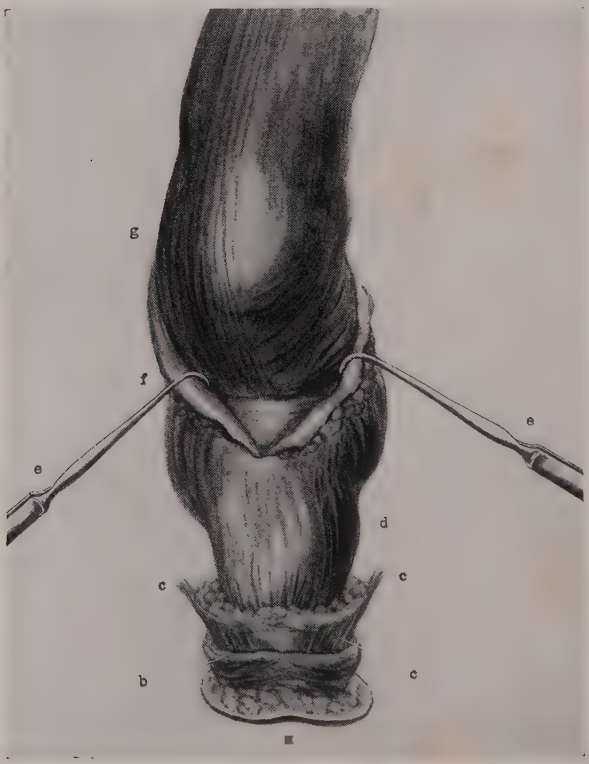


Fig. 4325.—Anatomy of the Anorectum – Anterior Aspect: – **a,** Anus; – **b,** external sphincter ani; – **c, c, c,** levator ani; – **d,** non-peritoneal aspect of the anterior rectal wall; – **e, e,** anterior reflection of peritoneum; – **f,** sacral concavity; – **g,** sacral convexity. (Modified from Quénu and from Ball.)

Iliac Colon is that portion of the sigmoid flexure lying in the iliac fossa, and a direct continuation of the descending colon, commencing at the left iliac crest and passing downward and slightly inward, turning mediad a little above Poupart's ligament, across the front of the iliac muscle, to end at its inner border (which corresponds, practically, to the brim of the pelvis), where it becomes the pelvic colon. It is generally from 12.7 to 15.3 cm. (5–6 inches) in length. It is usually connected to the anterior aspect of the ilopsoas muscle by connective tissue. It is, as a rule, only covered by peritoneum upon its front and sides – but in about 10 per cent. of cases it is entirely surrounded, having then a mesentery of about 2.5 cm. (1 inch).

Pelvic Colon; – is that portion of the sigmoid colon lying in the pelvis, and a direct continuation of the iliac colon, beginning at the inner border of the left psoas muscle – and, passing over the brim of the pelvis, it traverses this cavity from left to right and backward, to gain the median aspect of its posterior wall, to become the rectum proper. It averages from 40 to 42½ (16–17 inches) in length – extremes, from 12.5 to 89 cm. (5–35 inches). It has a full mesentery and is freely movable.



Fig. 4326.—Anatomy of the Anorectum – Posterior Aspect: – a, Anus; – b, b, posterior reflection of peritoneum; – c, external sphincter ani; – d, d, levator ani; – e, non-peritoneal aspect of the posterior aspect of the rectum; – f, superior hemorrhoidal artery and vein; – g, middle hemorrhoidal artery; – h, inferior hemorrhoidal artery. (Modified from Quénu and from Ball.)

Sigmoid Colon, or Flexure is simply the iliac colon plus the pelvic colon – and the term will be used, in these writings, to cover collectively both the iliac and colonic colons (v. s.). In some Anatomies, pelvic colon and sigmoid colon are used synonymously – treating the stretch of large intestine from the end of the descending colon to the beginning of the rectum proper as a single segment of bowel, omitting the designation of iliac colon – and this custom is probably the one most usually prevalent.

Rectum is a continuation of the pelvic colon, beginning at the level of the middle of the third sacral vertebra, where the pelvic mesocolon ends, and terminates at the levatores ani, where the bowel passes through the pelvic floor. It passes down in front of the sacrum and coccyx, and, after passing these, is supported by the pelvic floor (the junction of the two levatores ani in the middle line) for about 3.7 cm. (1½ inches), and then turns and pierces the pelvic floor, to become the anal canal. It is from 12.7 to 15.3 cm. (5–6 inches) in length – or longer. Usually the upper two-thirds of the rectum is covered by peritoneum anteriorly and laterally – and the lower one-third has no covering. The ampulla of the rectum is the dilated lower portion of the rectum (approximately 5 cm. or 2 inches), corresponding with the part that is entirely uncovered, and unsupported by peritoneum.

Anal Canal extends from the end of the rectum proper, that is, from the level of the levatores ani muscles, and terminates at the anus – and is flattened, from side to side, where compressed by the levatores. It is from 2.5 to 3.7 cm. (1–1½ inches) in length.

Anus.—The anal orifice is the slit-like lower ending of the anal canal, upon the surface of the perineum.

Rectosigmoid Apparatus.—W. J. Mayo stresses the features of this tract, writing – "The rectosigmoid, the narrowest part of the large intestine, consists of 3.5 inches (9 cm.) of the intestinal tract, which includes the terminal 2 inches (5 cm.) of the sigmoid and the proximal 1.5 inch (3.7 cm.) of the rectum. It is a definite mechanism which retards the fecal current and prevents continuous progress of the intestinal contents into the rectum. . . . The rectosigmoid is a distinct anatomic region which possesses some of the characteristics of the pylorus and of the ileocecal mechanism. . . . With the exception of the pyloric end of the stomach and the first portion of the duodenum, the rectosigmoid is more frequently diseased than any corresponding portion of the gastro-intestinal tract."

External Sphincter consists of a muscular cylinder surrounding the lower two-thirds of the anal canal – its innermost fibers being continuous, but most of its fibers having attachments anteriorly and posteriorly – tending, when in action, to draw the anal orifice into an anteroposterior slit.

Internal Sphincter consists of the thickened circular muscular coat of the lower portion of the anal canal.

Lymphatic Vessels and Glands of the Rectum.—The majority of the lymphatics of the rectum communicate with four or five rectal glands lying in the connective-tissue coat of the intestine in the course of the superior hemorrhoidal vein and its two branches, and from these they pass to the sacral glands, in front of the sacrum. Some of the lymphatics from the lower part of the anal canal communicate with the cutaneous lymphatics around the anus and, with them, pass to the superficial set of inguinal glands. According to Quénu, some of the lymphatics from the lower part of the rectum communicate with the internal iliac glands – but, according to Gerota, this is an inconstant occurrence.

According to Edward H. Taylor, the lymphatic glands which may become involved in cancer of the anorectal region are the following: – (*a*) the glands of the inguinal region; – (*b*) the gland situated upon the middle hemorrhoidal artery, and the glands connected with it, which are the external iliac group, the lateral sacral glands, and the glands at the bifurcation of the common iliac artery; – (*c*) the anorectal glands, and the main group of the inferior mesenteric glands. He states that the lymphatics of the lower part of the rectum proper chiefly communicate with the gland of the middle hemorrhoidal artery, and with those glands connected with it – and that those from the upper part

communicate with the anorectal glands — and that, therefore, the dissemination of cancer by lymphatic channels will involve the same groups of glands, whether the malignancy begins in the rectum or in the anal canal — the practical application of which, he states to be, that radical removal of lymphatic glands which may possibly be infected, necessitates not only a free and wide dissection of the pelvis, but, in addition, a high division of the bowel itself.

Methods of Dissemination of Rectal Cancer.—By direct extension into the immediately adjacent tissues — by lymphatic distribution — and by vascular distribution along the route of the portal circulation. The order of



Fig. 4327.—The Rectum and Pelvic or Sigmoid Colon — with Their Vessels, and the Anastomosis of the Latter: — As noted by Davis, and quoted by Taylor, the "critical point" at which the lowest sigmoid branch comes off from the inferior mesenteric artery is to be carefully observed — for unless the mesenteric trunk be ligated above this level, blood will not flow from above downward into the superior hemorrhoidal artery — the only direct anastomosis between the sigmoid and hemorrhoidal arteries being at the level of the lowest sigmoid branch. (Modified from Taylor.)

progress in which cancer dissemination proceeds is probably the following, — local extension — metastases by vascular dissemination — lymphatic dissemination. It has been pointed out by a number of Surgeons that local cancerous involvements of the rectum are often encountered which are quite operable from the standpoints of both local extension and lymphatic dissemination, but which, nevertheless, are actually inoperable because of vascular metastases to the liver and peritoneal cavity, which means that of two methods of dissemination from the original site of local disease, visceral metastases at a distance may block operation before adjacent lymphatic dissemination does. Rectal

cancer usually runs a relatively long course before lymphatic distribution contraindicates operation – and, if removed early, there is fair chance of avoiding recurrence.

Indications for Excision of the Rectum.—Parts of the anorectosigmoidal tract are most frequently excised for cancer. Proceeding from the anus upward, the first 3.2 cm. ($1\frac{1}{4}$ inch) of the canal is lined with squamous epithelium, and the form of malignancy encountered here is epithelioma – or adenocarcinoma, as a downward extension from the rectum, just above. This region furnishes about 6 per cent. of the cancers of the rectum (W. J. Mayo). The lower rectum (from the anal canal to the peritoneally covered rectum) is the site of 24 per cent. of the malignancies found – generally adenocarcinomata.

Preliminary Colostomy in Operating for Cancer of the Rectum.—Differences of view exist as to the preliminary performance of colostomy in

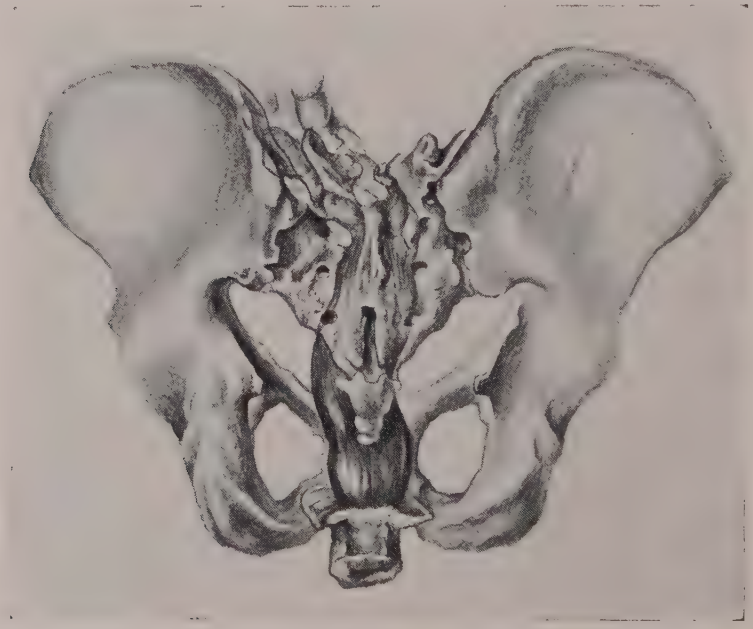


Fig. 4328.—Relations of the Rectum and Sigmoid to the Bony Pelvis Viewed from Behind (Modified from W. J. Mayo.)

advance of the excision of the rectum for cancer. Some Surgeons adopt the method more as a routine procedure, preliminary to the major operation – for two distinct reasons, – first, to enable the site of cancer, and of operation, to be more thoroughly prepared, by functional rest, and by local measures of cleansing, for the operation – and, second, to enable the site of operation to be as little disturbed as possible by the passage of feces over the resulting wound, following operation. Other Surgeons resort to preliminary colostomy not as a routine, but only in those cases where it is not otherwise possible, owing to considerable mechanical obstruction, to properly cleanse and prepare the site for operation. Where preliminary colostomy is performed, a portion of the colon should be selected sufficiently high enough up in its course even to the use of the transverse colon, not to interfere with the downward drawing of the sigmoid colon toward the anal orifice. If performed, the preliminary colostomy should be done about ten days or two weeks in advance.

The colostomy here referred to is meant as a temporary one – and is subsequently closed when no longer needed. In some cases, however, the preliminary colostomy is undertaken also as a permanent colostomy – or, undertaken as a temporary colostomy, becomes a permanent one through the exigencies of the case.

Preparatory Treatment in Excision of the Rectum.—The general condition of the patient should be gotten into as satisfactory a state for this major ordeal as possible well in advance of the operation. The local condition in average cases, and where no blockage is present, should be prepared by mild purgation – and by daily bowel irrigation, carefully administered,

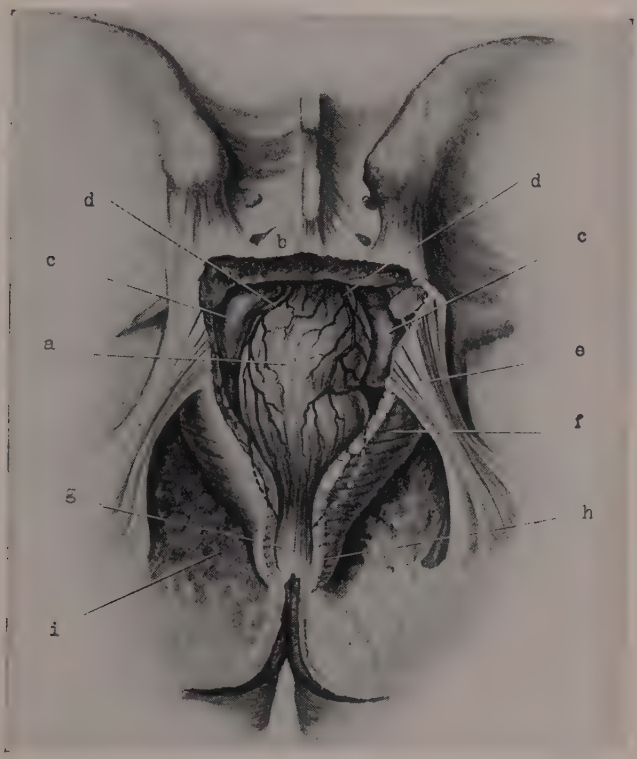


Fig. 4329.—Posterior View of the Rectum and Some of the Surrounding Parts: – a, Rectum; – b, bony section, below which the part of the sacrum and the coccyx have been excised; – c, c, peritoneal pouches of the pararectal fossa; – d, d, superior hemorrhoidal vessels; – e, great sacrosciatic ligament; – f, levator ani and coccygeus muscles; – g, anal canal; – i, ischiorectal fossa. (Modified from Cunningham.)

with plain or weakly antiseptic solutions. It has been proposed to preliminarily implant colonies of Bulgaric lactic acid bacilli within the colon.

Degree of Bowel Control to Be Expected Following Excision of the Rectum.—A patient should enter into an operation for cancer of the rectum amply satisfied if his life can be saved – and gratified, as an additional blessing, for any degree of functional control which the degree of the involvement and the nature of the operation may enable the Surgeon to preserve for him. It is not unnatural that this unfortunate group of patients should want to know, in advance, even if they do not try to stipulate with the Operator, as to what manner of an anus, and what degree of control, will be the result of their

yielding to radical operation — and yet close adherence to a desire to have the patient gratified on this score has, undoubtedly, been paid for by the life which a more radical procedure, without regard to more ideal conservation of bowel control, might have saved.

Some reasonable degree of control of solid movements may be expected — but less control of fluid movements — partly by the patient's physical mechanism, through the particular method of operating — and partly through pad-pressure, secured by instrumental means. It is not alone that the patient asks for bowel control, but that the artificial anus, if one be made, be as near its normal site as possible. Where the actually pre-existing anus, or its site, is not used, any other bowel opening in the perineal region becomes practically a perineal colostomy, and if thoroughness of technic in the excision of the rectum is to be sacrificed for a perineal bowel opening, as against a thorough removal, followed by an abdominal colostomy, then the warrantability of the procedure is more than doubtful. The decision of these points should, by previous agreement, be left with the Surgeon. Patients have, undoubtedly, often lost their lives to secure a perineal anus.

The Mayos state that the best bowel functioning which they have been able to obtain in connection with excision of the rectum has been with the tube method of resection — with direct end-to-end union between the end of the sigmoid and the anal canal (v. p. 283) — the method of Balfour and C. H. Mayo. They also report satisfactory results, in this respect, in cases where it can be applied, by the Weir method of invaginating the rectum above, and its growth, through the anus, then amputating the cancer and the rectum, and suturing together the ends by through-and-through sutures from the mucous surface.

The principle of operating calls not only for a wide removal of the growth but also of the lymph-nodes in the paths of lymphatic dissemination — and in order that these ends may be thoroughly accomplished, so much destruction is usually committed, especially to the muscles and nerves of the parts, that, as a result, it is usually impossible to leave the patient with an anus which has satisfactory sphincteric control.

Even though the anus itself may not be involved, if the cancer have its origin in the ampulla of the rectum, the anus must almost necessarily be also involved, even though apparently not — and should be removed (Fagge and W. J. Mayo).

Causes of Death Following Excision of the Rectum.—W. J. Mayo gives these, in the order in their proportional frequency, as follows: — sepsis, 39.8 per cent. — nephritis, 13 per cent. — undiscovered metastatic tumors, 10.5 per cent — hemorrhage, 6.5 per cent. — bowel obstruction, 3 per cent.

Excision of the Rectum, in General.—Rectectomy, or proctectomy, consists in the excision of the rectum in whole or in part. It is generally resorted to for malignant disease, in cases where there is little or no involvement of neighboring viscera or lymphatic glands. The operation may be done through the perineum — through the sacrum — through the vagina — by the abdomen — or by the combined abdominal and perineal routes. Proctectomy may be partial or complete.

Partial proctectomy by the perineal route is generally confined to cases in which the malignant growth is within 10 cm. (4 inches) of the anus — and, in women, in which the anterior rectal wall is not involved higher up than 7.5 cm. (3 inches). With some the indication for the perineal route is a growth within 5 cm. (2 inches) of the anus. Moderately high growths are approached by the sacral route. Very high involvements should be approached by the combined perineal and abdominal routes.

If uninvolved, the sphincters should be preserved _ provided their nerve-supply, which reaches them from their lateral aspects, can be retained intact _ and subsequently the proximal end of the rectum should be attached to the distal end containing the sphincters. Safety of the patient should not be jeopardized to accomplish these ends.

A wide removal of circumanal and circumrectal tissues, especially lymphatic, is indicated in all malignant involvement. If limitedly involved, the prostate gland, part of the bladder, or the rectovaginal septum should be removed. Metastases usually contraindicate operation.

Methods of Operating for Cancer of the Anorectum and Rectosigmoid. —The method of operating and the technic to be employed will be largely determined by the position and nature of the involvement.

(*A*) Percentage Localization of Anorectal Cancer _ Taylor: _ (*a*) Cancer at or near the sphincteric zone (anal and anorectal growths), about 6 per



Fig. 4330.—Anatomy of the Superficial Anorectal Coccygeal Region: _ a, Coccyx; . b, sphincter ani; _ c, anococcygeal ligament; _ d, gluteus maximus; _ e, levator ani.

cent. of the cases (according to Tuttle); _ (*b*) Cancer of the suprasphincteric portion of the rectum, but below the rectovesical peritoneal reflection in the male, and the rectovaginal reflection in the female, about 25 per cent. of the cases; _ (*c*) Cancer occurring at the beginning of the rectum, and extending thence upward, sometimes into the pelvic colon, in about 65 per cent. of cases.

(*B*) Choice of Method, or Route of Operation, as Summarized by W. J. Mayo: _ The first (lowest) 3.2 cm. ($1\frac{1}{4}$ inch) of the anal canal (which is lined by pavement epithelium) may be involved by epitheliomata or by adenocarcinomata extending downward from the rectum. In some cases seen early and where the growth is superficial and localized, simple local excision of the growth itself or cauterization may be successfully employed. But if the condition be more extensive, the anus should be excised by the Cripps method and the inguinal glands be removed.

If the lower rectum, from the anal canal to the peritoneal reflection, be in-

volved, the Cripps, the Quénu-Tuttle, and the Hartmann methods, with or without the excision of the cocyx, are indicated _ the divided end of the upper rectum being sometimes drawn through the anal canal, denuded of mucosa, and sutured to the anal orifice, or, more frequently, anchored to the skin surface at the site formerly occupied by the coccyx.

If the upper rectum, which extends from the upper limit of the lower rectum to the rectosigmoid junction, opposite the third sacral vertebra, be involved, the Kraske operation may be performed.

Excision of cancer of the rectum and rectosigmoid should be done by the two-stage interval operation. If, in operating intra-abdominally, the bowel can be divided low enough below the growth to leave 1.3 cm. ($\frac{1}{2}$ inch) or more of peritoneally covered rectum within the culdesac, and provided the amount of the bowel to be excised is not too great to make junction of the divided ends impossible, a tube resection, with the conservation of the anal outlet, may be performed in a single stage.

In cancer of the rectum and rectosigmoid in which the excision cannot be made with the conservation of the peritoneally covered distal bowel, it is best to operate in two stages _ by the combined intra-abdominal and perineal routes.

Cancer of the lower sigmoid and extending nearly to the rectosigmoid may be well treated by the Mikulicz three-stage operation.

Bloodgood has secured some of the desirable features of the Mikulicz three-stage operation as a primary, single-stage operation, in selected cases _ by excising the growth, invaginating both ends of the bowel, anastomosing them side-to-side, and anchoring them to the abdominal incision within the abdomen (within reach of easy opening, if necessary).

The combined intra-abdominal and perineal operations as a one-stage procedure is accompanied by a very high mortality—20 to 36 per cent.

(*C*) Choice of Method, or Route of Operation, as Summarized by F. S. Edwards, _ which assigns tumors of the anorectal tract, of the following sites, to the following routes of removal: _ (*a*) tumors of the anal canal _ by the perineal route, _ (*b*) tumors between the upper border of the external sphincter and the third sacral vertebra _ by the sacrococcygeal route, _ (*c*) tumors above the third sacral vertebra _ may require removal by abdominal operation, or by combined abdominosacral, abdominoperineal, or abdomino-anal routes, _ (*d*) tumors involving the vaginal wall _ may be removed by the vaginal route.

No hard-and-fixed rule exists, however, in any of the attempts to classify the various involvements under the most appropriate methods for their removal _ any further than as suggestive of generally accepted views, in the light of practical experience. The experience and judgment of the individual Surgeon must determine the fitness of a procedure for each specific case.

The Author, however, would stress the general tendency and the general desirability of extending to a larger number of cases the inclusion of abdominal section, as a part of the procedures connected with the surgical treatment of rectal cancer _ and for two especial reasons _ first, because the question of metastases cannot be definitely decided without abdominal section (which if present would contraindicate radical operation, and thus save the patient useless mutilation) _ and, second, because with an open abdomen and pelvis, the technical details of a radical operation can be carried out not only more thoroughly but also with less destruction to surrounding parts, especially muscle and nerves upon which both rectal and bladder function will subsequently largely depend _ and which one often sees, or knows to be, crudely torn to pieces by working in the dark through the perineum alone. The Author can think of but one argument against the more general application of abdominal

section as a part of the operative technic in these cases, and that is, sepsis, which is the most frequent cause of death following operation – and which, with a peritoneal cavity that had been opened, would have to be additionally guarded against.

EXCISION OF THE RECTUM BY THE PERINEAL ROUTE

QUÉNU-TUTTLE TECHNIC

Description.—The especial field of application for the excision of the rectum by the perineal route is the presence of cancer of the anus, anal canal (which extends from the skin to the levatores ani), and the ampulla of the rectum (the dilatation of the lower rectum). In pronounced malignant involvement the anus, anal canal, and the lower portion of the rectum are excised,

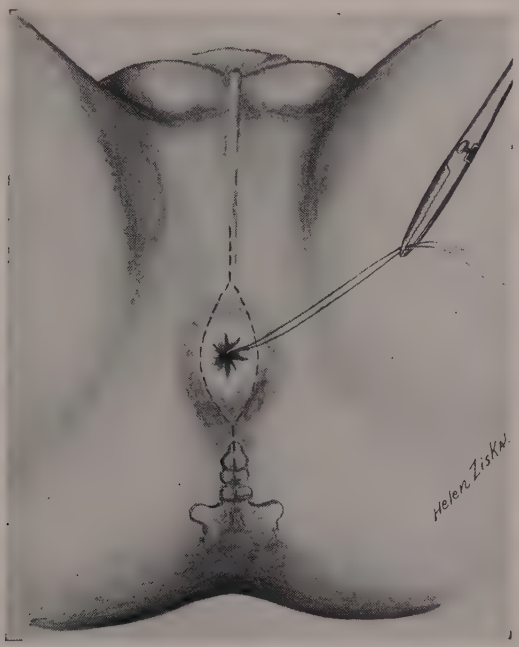


Fig. 4331.—Excision of the Rectum by the Perineal Route – Quénu's Technic – I; – The perineal incision. The anal orifice has been, here, closed by suture, the ends of which are being used as tractors. The patient is in the lithotomy position.

along with their muscles and adjacent connective tissues – the approach being through a perineal median incision, with or without excision of the coccyx. The hemorrhoidal and lateral sacral lymphatics are to be excised – and if the pavement epithelium of the anus be involved, the inguinal lymphatics as well. The severed end of the rectum is finally anchored in the perineal wound, as nearly in its original site as possible and within the grip of the external sphincter, if this be preserved.

Preparation.—See Excisions of the Rectum, in General, p. 222.

Position.—The patient lies in the exaggerated lithotomy position, with his sacral region elevated by a small cushion and his buttocks projecting over the end of the table. The Sims position is sometimes used, though less conveniently. The Surgeon sits opposite the projecting buttocks.

Landmarks.—Anus; tip of the coccyx; midperineum; and, later, the posi-

tion of the rectum, prostate, bladder (which should be empty); floor of the pelvis (levatores ani); peritoneal reflection _ and in the female, the vagina and uterus.

Incision.—The incision is a median perineal one, consisting of anterior and posterior parts. The anterior portion extends from the anterior aspect of the anus to the urethral bulb (that is, nearly to the scrotum) _ or nearly to the vagina, in the female. The posterior portion of the incision passes between the posterior aspect of the anus to the tip of the coccyx _ and, if the coccyx is to be excised, the incision leaves the median line at the tip of the coccyx, and passes along one side of the coccyx until its base, or sacrococcygeal junction, is reached _ or is continued right over the center of the coccyx. The manner of connecting the anterior and posterior median incisions around the anal orifice will depend upon circumstances. If it be possible to save the external sphincter, which is often possible, if the cancer involves the rectum proper,

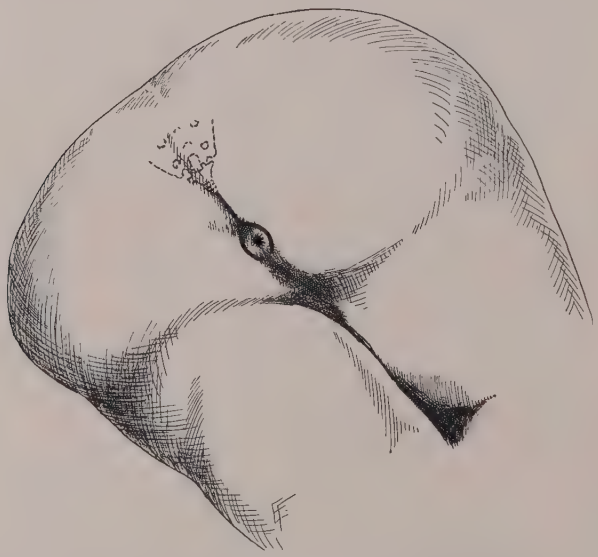


Fig. 4332.—Excision of the Rectum by the Perineal Route _ Quénu's Technic _ I; _ With the patient in Sims' left lateral position. The perineal incision.

a circular incision is made through the skin, around the anus, at the mucocutaneous junction, after which the mucous membrane of the anal outlet is dissected all around, and upward to the distance of about 1.2 cm. ($\frac{1}{2}$ inch). If the external sphincter be included in the cancerous involvement, the circular or slightly elliptic incision which surrounds the anus must be made through the skin outside of the anal orifice (Figs. 4331 and 4332).

Operation.—In those cases in which the external sphincter can be saved some Surgeons begin the operation by dilating the sphincter _ while others omit this preliminary procedure. The final cleansing of the rectum is carried out on the table _ after which the anorectal canal is lightly packed with gauze. In addition to this light packing of the anorectum, the canal is usually further controlled in one of two ways _ either by a purse-string suture placed superficially through the parts just internal to the site in which the circular incision will be carried around the anus (Fig. 4333) _ or by the ligature of the detached anorectal tube in the early stage of the operation.

In those cases where the external sphincter ani can be preserved, the procedure is as follows: _ The anterior median incision is deepened between the urethral bulb in front, and the rectum, posteriorly, until the plane of the preanal fibers of the levatores ani (also called the recto-urethralis muscle) is reached. Through this part of the perineal incision, and after the levators are divided, the rectum is freed, from below upward (guided by a sound through the urethra into the bladder), from the bulb, prostate, seminal vesicles, and bladder, by blunt dissection, up to the rectovesical reflection of peritoneum _ or, in the female, from the vagina, guided by an Assistant's finger within the vagina. The posterior median incision is, at first, carried only to the tip of the coccyx, and the coccyx is not excised unless more working room is required than can be otherwise procured. In the latter event the posterior median incision is, as a rule, continued in the median line, over the center of the coccyx, to the sacrococcygeal articulation or higher _ or it may be carried from the tip of the coccyx along one of its lateral margins to the sacrococcygeal joint. The posterior median perineal incision is deepened between the posterior margin of the anus and the tip of the coccyx, through the connective tissue and anococcygeal raphé _ until, by combined sharp and blunt dissection in the median line, the levatores supporting the rectum are exposed.



Fig. 4333.—The Perianal Purse-string Suture in Greater Detail; _ This suture may appear upon the skin surface at the end of the half-circle, or at intervals.

It is at this stage that the coccyx is excised, if more space for manipulation be necessary for satisfactory work than can otherwise be secured. The tip of the coccyx is freed of the anococcygeal ligament and levatores ani, and its lateral aspects of the coccygeus and gluteus muscles (Fig. 4334). If still more room be needed, the excision of the coccyx may be followed by excising the lower part of the sacrum _ though this is but rarely called for in the special form of operation under consideration.

In saving the external sphincter the circular or very slightly elliptic incision surrounding the anus is placed in the mucocutaneous line inside of the external sphincter. The anorectal canal is then dissected upward, all around, for about 1.2 cm. ($\frac{1}{2}$ inch) _ after which the anorectal cylinder is circularly ligated with stout silk, the end of the ligature being left long as tractors (unless it have been previously closed by suture). The control of the anorectal outlet by ligature is probably more satisfactory than the control by suture. The portion of the freed rectal tube below the ligature is then sterilized either by the actual cautery or by pure carbolic acid. The external sphincter will have been incised in its cleavage, in the median line, up to and outside of the rectum, both anteriorly and posteriorly. (Some Surgeons prefer to reverse the order, and to first free this lower segment of the anorectum before making and deepening the anterior and posterior median perineal incisions.) The rectum is now freed from its attachments up to the attachment of the levatores ani _ the sphincters, if not diseased, being left in the skin flaps (one-half in

each flap), which are then retracted to opposite sides. The rectum is freed up to the muscular floor of the pelvis, the levators largely by blunt dissection.

The levatores ani are divided close to their attachment all around the rectum. This severing of the levatores from the rectum is best accomplished by first splitting them in the median line either anteriorly or posteriorly – the latter generally being the easier, as the levatores are much more accessible (nearer the surface) posteriorly than anteriorly. As the rectum is swung, as in a hammock, between the two united levatores, it cannot be substantially freed and appreciably drawn down until these levatores are cut from their attachment entirely around the rectum. After the levatores are split in the median line of their junction one blade of a pair of curved, blunt-pointed

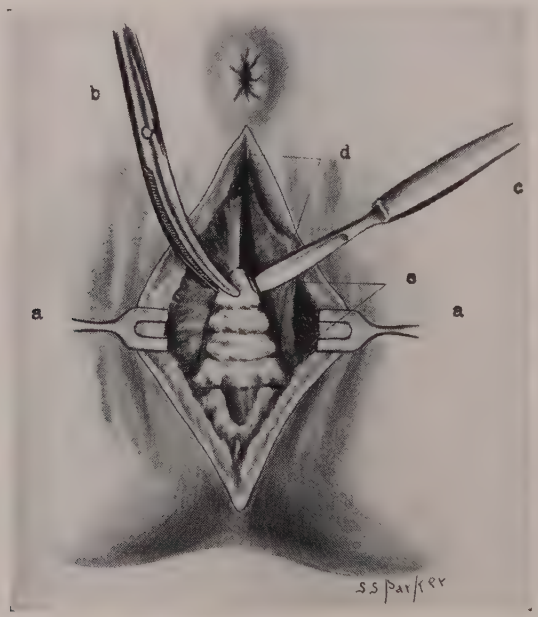


Fig. 4334.—The Same – II; – Excision of the Coccyx: – a, a, Retractors of median perineal wound; – b, forceps retracting the tip of the coccyx; – c, knife dividing the anococcygeal ligament and levatores ani in the median line, d, and the coccygeus and gluteus maximus along the coccygeal border, e. The bone is disarticulated along the transverse dotted line at the sacrococcygeal articulation.

scissors is passed into the opening thus made, and is pressed with its cutting edge downward, hugging the rectum, so as to divide the levator of that side transversely and circularly close to its attachment to the rectum – guided by a finger passed above the levator and between it and the rectum. This splitting and division of one side of the levator is shown in Fig. 4335. When the levator of one side is divided, it is easy to divide the opposite one. Just before the final division, it is well to clamp the levator above the level at which the division is to take place, in order to prevent its retracting inconveniently out of reach for future manipulations (Fig. 4336).

When the rectum has been freed in its entire circumference, by the division of the levatores ani, and all vessels which have been divided in the course of the operation up to this point have been tied, the rest of the freeing of the rectum up to the peritoneal reflection is accomplished by blunt dissection, chiefly by

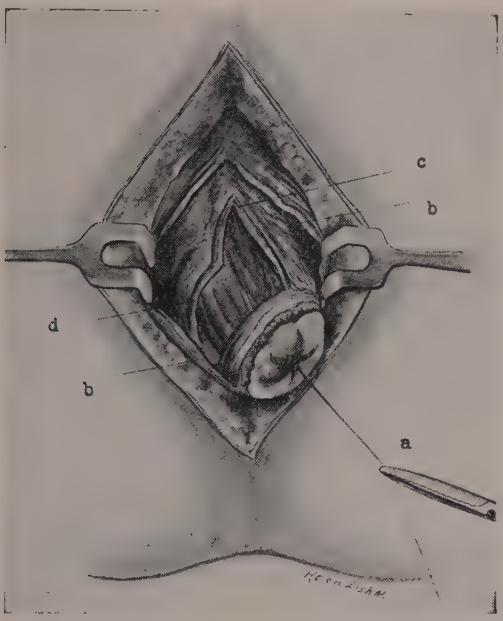


Fig. 4335.—The Same – III: – a, Traction upon the rectum which is being freed; – b, b, external sphincter incised around the anus and left in the wound. Levatores ani split, c – and circularly divided on the right, d.

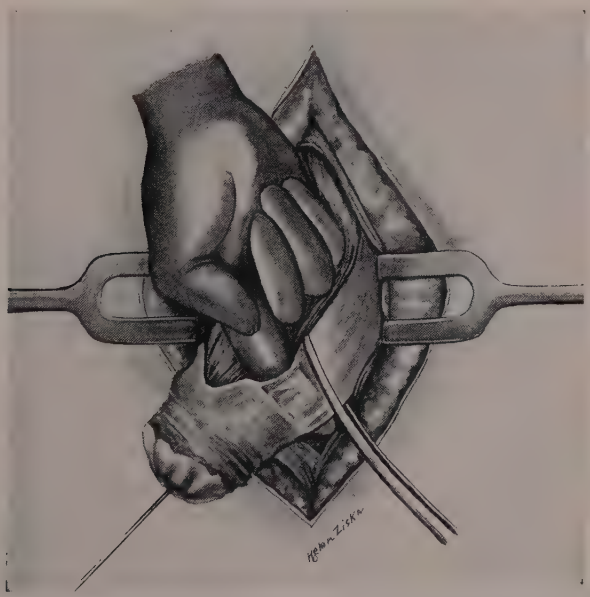


Fig. 4336.—The Same – IV; – Finger inserted between the rectum and the left levator; – clamp enclosing the levator above the finger, preparatorily to dividing the levator between the finger and the clamp.

means of the index-finger, through the areolar tissue connections of the superior pelvirectal spaces. When the connective tissue has been divided – and some

of its lateral connections to the rectum may have to be clipped with scissors – the rectum can usually be drawn well out of the perineal wound (Fig. 4337).

When the tumor extends beyond the peritoneal reflection, or so near to it that insufficient room is left for safe division above it, provision must be made for freeing the rectum above the peritoneal culdesac. In some instances, especially where a very little more room is required, the peritoneum may be pealed, or stripped upward from the rectum – but in some cases it is necessary,

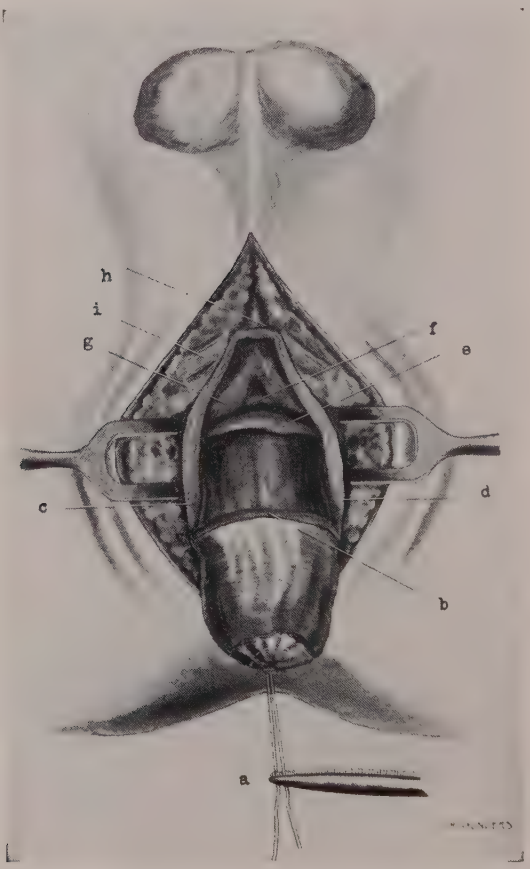


Fig. 4337.—The Same – V: – a, Partially freed, retracted rectum after division of the levatores; – b, line of separation of levatores ani from the rectum; – c, d, margins of medially divided levatores, and, superficially overlying them, of the anococcygeal ligament; – e, pouch of rectovesical peritoneum protruding; – f, prostate gland; – g, right vesicula seminalis; – h, bulbocavernosus; – i, transversus perineus. The anus and middle portions of the rectum are thus freed. (Figs. 4337 and 4338 modified from Kelly and Noble.)

and in all borderline cases it is more desirable, to open the peritoneal cavity – and this is imperative when the growth encroaches upon the peritoneal reflection. Even if the peritoneum could be pealed back without incising it, in cases where its level is not involved, the rectum would often be so held by its peritoneal attachments as not to be able to be brought down far enough into the peritoneal wound. Usually from 6.3 to 7.2 cm. ($2\frac{1}{2}$–3 inches) are traversed, in the perineal dissection, before the peritoneum is reached. If the coccyx

have not been already excised, this is sometimes done at this stage – or the coccyx may be temporarily turned back, or broken back, at the sacrococcygeal joint. The rectum is separated from the hollow of the sacrum by blunt dissection in the connective-tissue plane, separating the cellular and fibrous connections digitally – after which the peritoneum is divided anteriorly and laterally and the mesorectum is cut near to the sacrum, so as to avoid injuring the middle hemorrhoidal artery. The sacral glands are removed in this separation.

Nothing now prevents the movable sigmoid from being displaced downward, and the rectum from being drawn freely out of the wound (Fig. 4338). It is drawn well downward, to determine the site at which it is to be divided and

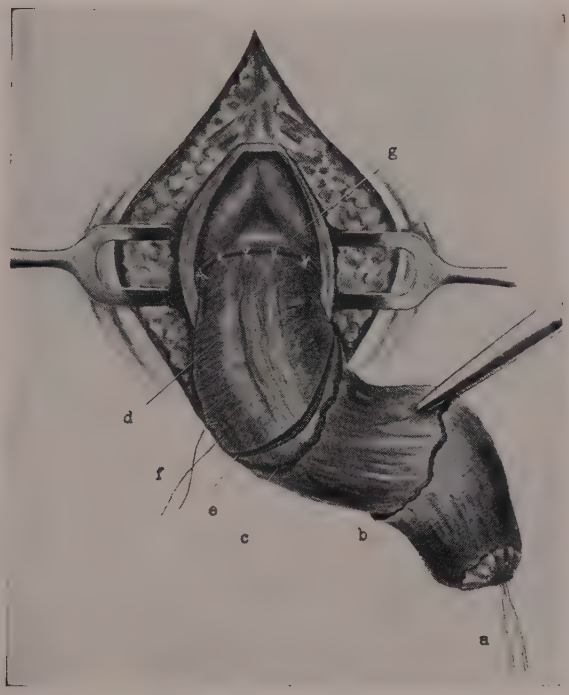


Fig. 4338.—The Same – VI: – The peritoneum has been incised, and then sutured to the rectum: – a, Anal and sphincteric portions of the rectum; – b, line of attachment of levatores ani; – c, line of lower anterior peritoneal reflection; – d, peritoneal portion of rectum; – e, line of division (excision) of the rectum – with anchoring sutures, f, in the margins of the perineal wound; – g, line of sutures of the peritoneum to the sigmoid.

anchored in the perineum. While held in this position the peritoneal cavity is closed by suturing the parietal peritoneum anteriorly and laterally to the rectal wall (where the drawn-down portion of rectum passes through the incised peritoneum) by means of fine chromic catgut, or silk sutures – as shown in the illustration just quoted – the sutures not penetrating into the lumen of the bowel. When the peritoneal cavity has been closed the divided median margins of the levatores ani are sutured together with fine chromic catgut – both in front of the rectum and behind it – and the portions of the free borders of the levatores which are opposite the rectum are sutured to its sides. This closure of the split levatores is seen in Fig. 4339 (where, however, the lateral and posterior sutures are not seen). At this stage the rectum is

often lightly clamped above the site of its division, and then divided. It is probably better to place a couple of anchoring silk sutures through the lateral margins of the wound, and then through the outer coats of the rectum, just above the intended division, and tie these, so that the severed end of the rectum will not retract – although no great retraction could take place even without them, after the anchorage of the levatores to the sides of the rectum. Finally, the rectum is entirely divided circularly – and its free margins sutured to the free margins of the perineal skin by through-and-through silk or silkworm sutures (Fig. 4340). Any vessels which bleed, in the divided rectum, are ligated with fine catgut. If the external sphincter have been preserved, its divided portions must be brought together by buried chromic catgut sutures. A rubber drain is placed in the anterior part of the perineal wound – and another in the posterior – the drains passing between and above the sutured margins of the levatores ani. The perineal wound is elsewhere closed with silkworm filament. A rubber rectal tube is placed within the rectum, and held there by a stitch or two. The bowels should be moved at the end of a week by gentle measures.

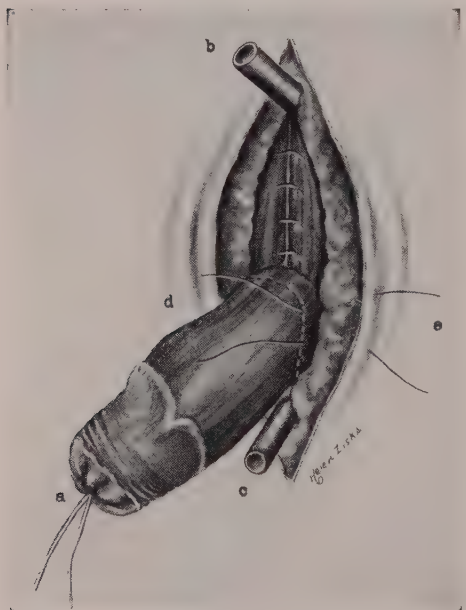


Fig. 4339.—The Same – VII; – The split levatores have been sutured: – a, Rectum freed and drawn forward; – sutures are seen closing the margins of the levatores ani; – b and c, drainage-tubes passing between the borders of the levatores, in front and behind the anus; – d, section of the rectum; – e, anchorage sutures of the excised rectum, to the perineum (entering and emerging from the rectal wall just above the level to be divided).

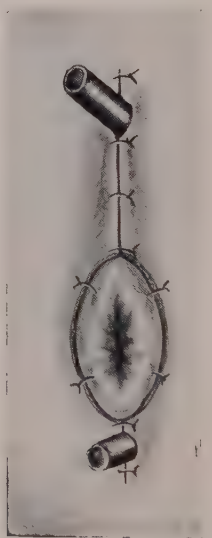


Fig. 4340.—The Same – VIII; – The excised rectum stitched to the perineal skin – the rest of the perineal wound being closed, except where a drain makes its exit, above and below.

Comments.—The light packing of the rectum with gauze, in advance of operating, is largely for the purpose of enabling the contour of the rectum to be more readily recognized during the manipulation in the deep perineal wound.

Instead of beginning the operation by the anterior and posterior median perineal incisions, as described in the body of this description, it is probably

more frequently the case, as well as sometimes easier, to begin the operation by the circular incision around the anus, and the freeing of the lower part of the anorectal canal between the wall of the rectum and the external sphincter _ carefully preserving the latter when this can be saved. Where the external sphincter is involved, or the borderline is too narrow for safety, the incision which surrounds the anus must extend outside of, and include, the external sphincter.

The manipulations of the deep dissection are aided if the rectum be forcibly retracted to the side directly opposite the one upon which the dissection is being made.

While the levatores are divided more or less transversely to the direction (axis) of the rectum, the fibers themselves of the levatores are divided more or less in their cleavage line.

It is the severing of the anterior fibers of the levatores ani and the anobulbar raphé which frees the lower aspect of the rectum anteriorly, and gives access to the superior pelvirectal spaces.

The rectum should be divided, at a minimum, at least 2.5 cm. (1 inch) above the highest suggestion of disease.

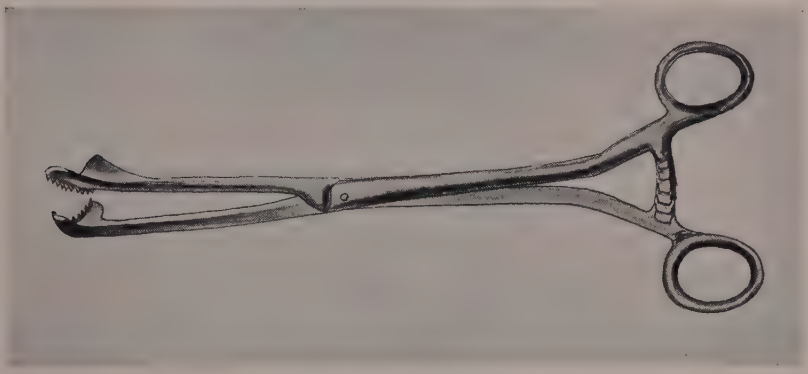


Fig. 4341.—Désjardins' Rectal Clamp.

Where the external sphincter has been excised along with the rectum the divided end of the rectum should be anchored in the perineal wound in as nearly its original position as possible.

The technic above described is not so readily carried out in women, owing to the presence of the vagina _ and does not seem to hold any advantage over excision by the vaginal route.

Tuttle relates having removed as much as 12.7 cm. (5 inches) of the rectum by this procedure. He endorsed the perineal route where amputation of the rectum was to be carried out _ but not where resection of a growth which would leave as much as 5 cm. (2 inches) of healthy rectum immediately above the anus.

It is of especial importance to preserve the blood-supply of the rectum immediately above the level of section _ which is best accomplished by hugging the sacral cavity closely in cutting the mesorectum and freeing the posterior aspect of the bowel, and in removing the sacral glands so as not to injure the middle hemorrhoidal artery, which would expose the rectum to sloughing.

Bowel incontinence and urinary incontinence sometimes follow the operation _ and every care should be exercised during its performance to avoid injury to the muscles and nerves of both bowel and bladder.

A form of clamp for conveniently handling the rectum is shown in Fig. 4341.

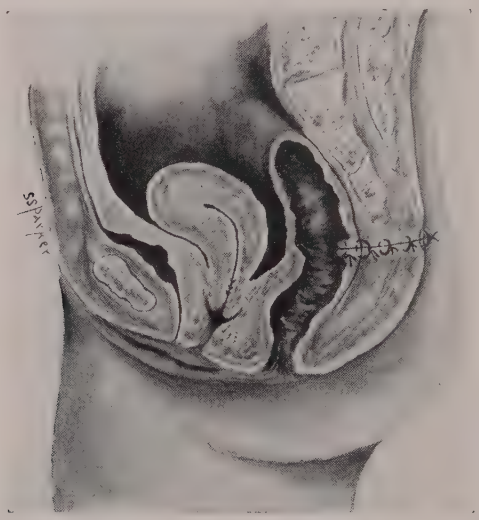


Fig. 4342.—Restoration of the Sacral Anus, Where the Rectal Wall Cannot Be Mobilized and Brought to the Skin of the Sacral Region; – The detached margin of the artificial anus, exposed from without, is closed by suture and inverted – after which the freshened wall of the fecal sinus is closed by tier suturing. If the lower part of the rectum has been removed the lower tract is made through connective tissue.

It sometimes happens that a temporary perineal anus may, in the course of operation, be found possible – which may, subsequently, be restored as shown in Fig. 4342.

COMPLETE PERINEAL PROCTECTOMY WITH CONSERVATION OF SPHINCTERIC CONTROL

BALL'S TECHNIC

Description.—The basis of the operation is the contention that any operation which circularly divides and separates the levatores ani completely around the rectum necessarily destroys the nerve supply of the sphincters which, also necessarily, causes loss of sphincteric control, – and the avoidance of this division is the object of the present operation. The procedure is only applicable where the disease does not extend low enough to involve the anal canal, for when this is the case, he holds that no sphincteric control can be preserved by any form of operation. He considers the operation feasible when the involvement does not extend in a downward direction lower than the ampulla of the rectum.

Operation.—The patient, with rectum cleansed by purgation and enemata, is placed in the exaggerated lithotomy position – with the thighs fully flexed and separated, and with the position so extreme that the perineum is practically horizontal. The anal canal and rectal ampulla are firmly plugged with gauze soaked in a solution of 1:500 mercuric iodid solution in spirit. The skin area is thoroughly disinfected – and gloves are worn.

A straight anterior incision is made in the center of the perineum, from the cental point of the perineum to the anterior aspect of the anus – and a straight posterior incision from the posterior aspect of the anus to the base of the

coccyx. After having excised the coccyx the external sphincter and levatores ani are split in the median line as far forward as the anus – and the fascia propria is divided. Anteriorly, the external sphincter, levatores ani, and the recto-urethralis muscles are split from the front of the anus to the central tendinous point of the perineum and the urethral bulb. With the levatores split anteriorly and posteriorly, it is easy to tunnel, with the index-finger, from one opening to another, on both sides of the rectum and along the superior surfaces of the levatores, in the superior pelvirectal spaces. Through this tunneled route, above the levatores, a stout silk ligature is conducted (Fig. 4343) and made to surround the rectum immediately above the insertion of

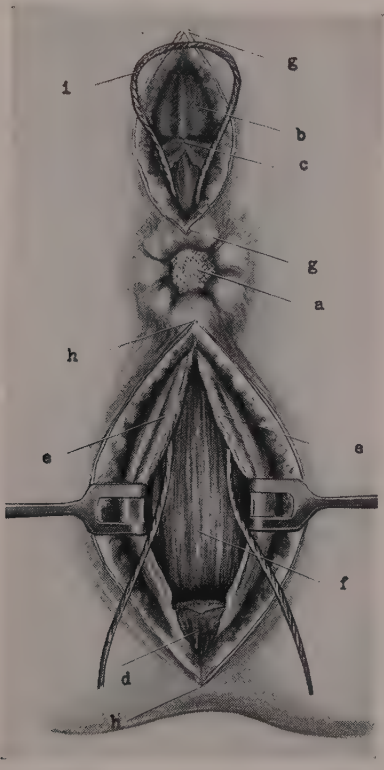


Fig. 4343.—Ball's Complete Perineal Proctectomy with Conservation of Sphincteric Control – I: – a, Rectum packed with gauze; – b, urethral bulb; – c, central tendinous point of the perineum; – d, base of the coccyx; – e, split levatores ani; – f, rectum; – g, g, anterior incision from the anus to or beyond the central tendinous point; – h, h, posterior incision, from the anus to the sacrococcygeal junction; – i, loop of stout ligature to be applied above the levatores ani, to the freed rectum. (Figs. 4343-4346 modified from Ball.)

the levators (pelvic diagram) – after which it is tied tightly down upon the gauze plug which was inserted at the beginning of the operation. Thus tying the ligature holds it more steadily and, at the same time, damages the rectal wall less. It is important that the ligature be tied about 1.2 cm. ($\frac{1}{2}$ inch) above the insertion of the levatores, to provide for the subsequent circular section of the rectum without the slipping of the ligature – and this maneuver is aided by passing the blades of a pair of forceps through the tunneled space and separating them. If insufficient room be left below the ligature, or if the ligature slip, the technic is considerably impaired.

As soon as the ligature has been secured, the anterior and posterior median incisions are connected _ by being continued through the external sphincter and the anorectal wall, anteriorly and posteriorly, directly in the median line _ after which the rectum is transversely severed, circularly, above the pelvic diaphragm (insertion of the levatores) _ the blades of the forceps still being held apart during the division _ and the two halves drawn aside (Fig. 4344). The structures retracted on each side are one-half of the full thickness of the lower rectal canal, half of the sphincteric apparatus, and the divided levator of that side. The essential feature is that each half retains its own portion of sphincter, together with its nerve-supply, for future use. It is well to further secure the gauze plug against slipping by two or three mattress-



Fig. 4344.—The Same _ II: _ a, a, Retractors of the anteriorly, b, and posteriorly, c, divided anus, and split levatores ani d and e; _ f, base of bladder; _ g, g, severed attachment of the levatores ani to the anus; _ h, ligament around the freed gauze-packed rectum.

sutures placed as shown. These are cut short so that they will not be used as tractors.

The rectum, thus partially freed, is further freed, largely by blunt dissection, while being drawn down into the wound. It is freed, in front, from the bladder, or vagina, as the case may be, and the anterior peritoneal pouch exposed and opened. Posteriorly, the pelvic colon is drawn down, and the superior hemorrhoidal artery tied in its mesocolon. By carefully drawing down this loop, the lateral ligaments are put under tension and can be divided, after previous ligature to control bleeding from the middle hemorrhoidal arteries. With all attachments divided, and the sacral lymphatic glands and vessels cleared away, the entire length of rectum can be drawn out of the perineal wound (Fig. 4345). The peritoneal opening is closed by suture _ although Ball states

that it is doubtful whether this is always necessary. The inner margins of the split levatores ani are sutured together with chromic catgut, and the anteriorly and posteriorly divided sphincter muscles are likewise carefully repaired by suture _ and the posterior loop of the puborectalis muscle is sutured with particular care. Before completing the suturing of the margins of the levatores ani a drainage-tube is carried into the superior pelvirectal spaces, to make their exit between the skin margins. In concluding the operation the pelvic colon is transversely divided between two ligatures _ and the proximal end is anchored in the normal anal outlet by several sutures which do not penetrate into the lumen of the bowel (Fig. 4346). The proximal one of the two ligatures (just beyond which the rectum was divided) may remain in position for two or three days to prevent soiling of the wound.

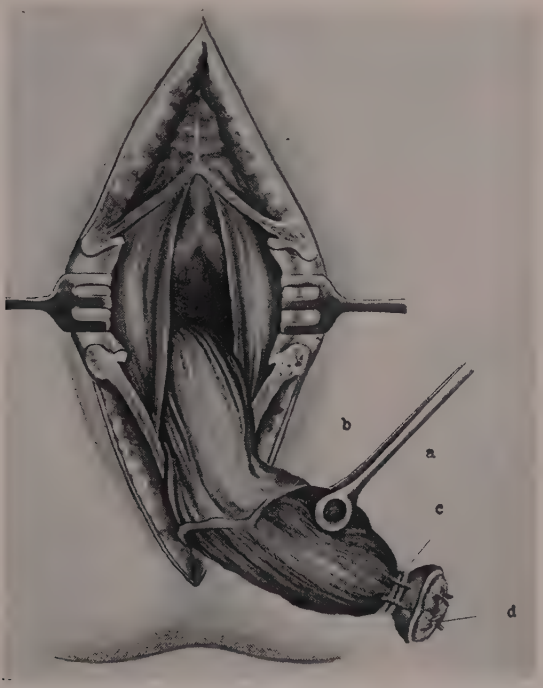


Fig. 4345.—The Same _ III: _ **a,** The freed rectum delivered outside of the perineum _ freed from the bladder in front, and severed from its peritoneal attachments; _ **b,** line of peritoneal attachment; _ **c,** circular ligature to control rectal contents; _ **d,** sutures holding gauze against the anus.

While Ball does not mention it as a part of the technic, it would seem desirable to remove the mucosa from the remnant of the anal outlet before anchoring the end of the pelvic colon, so as to promote union.

If a loop of pelvic colon cannot be drawn down far enough for anchorage, after extensive mobilization, which must be very unusual, the bowel is severed between ligatures, as high as possible, and the operation is ended by a colostomy.

Comments.—The special advantages claimed by Ball for the above technic are the following: _ The saving of the wound from soiling, _ ease with which the rectum may be mobilized, without damage, due to the free anterior and posterior incisions, _ readiness of ligation of the superior and middle hemorhoidal arteries, prior to their division, _ ability to retain relatively normal relations (except for the median incisions) of the sphincteric apparatus and

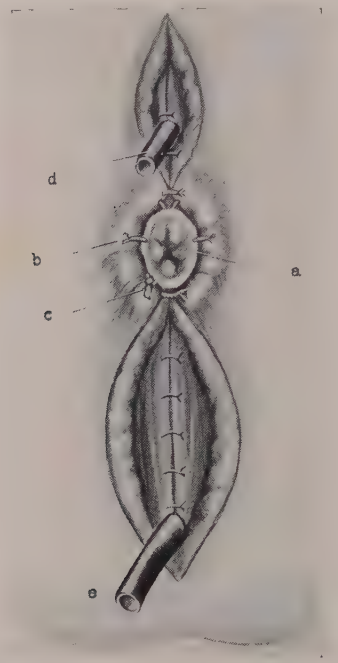


Fig. 4346.—The Same _ IV: _ a, a, Restored (resutured) anal orifice; _ b, wall of the divided rectum (or colon) sutured into the old anus; _ c, ligature around the rectum (to remain until adhesions form); _ d, anterior drainage passing through the sutured levatores ani; _ e, posterior drainage similarly placed between the sutured levatores.

pelvic diaphragm, with preservation of the nerve supply, _ and free access to the lymphatic vessels and glands.

PARTIAL PERINEAL EXCISION OF THE ANORECTUM, WITH CONSERVATION OF SPHINCTERIC CONTROL

BALL'S TECHNIC

This modification of the above technic has been applied by its originator to involvements of only a portion of the circumference of the lower anorectal canal. The operation is begun by making a curvilinear or semicircular incision around that part of the anal orifice corresponding with the site of disease _ and this is deepened up to the corresponding part of the levator ani _ the two limits of the incision through the perineum being continued upward by two parallel vertical extensions. All incisions are made well outside of the growth, especially the two lateral limbs, and the height of their upward extent. The flap that is thus outlined by incisions upon three of its aspects is then grasped and drawn down _ until the site of growth is sufficiently below the anal orifice to enable a sufficient width of sound tissue to be clamped above it (Fig. 4347). The flap bearing the diseased structure in its center is then excised transversely _ and the free margins sutured to the free margins below, and where the lateral margin of each flap is doubled upon itself (Fig. 4348). This suturing should be done with unusual accuracy, by both deep and superficial sutures, so as to shut off the field from infection into the perirectal tissues, as well as to close all dead spaces, for these wounds are particularly apt to become infected _ which in all operations upon the rectum is the chief cause of failure.

All in all, partial operations for malignancy are generally undesirable – as of all conditions, these demand the greatest radicalism. However, the fact that a

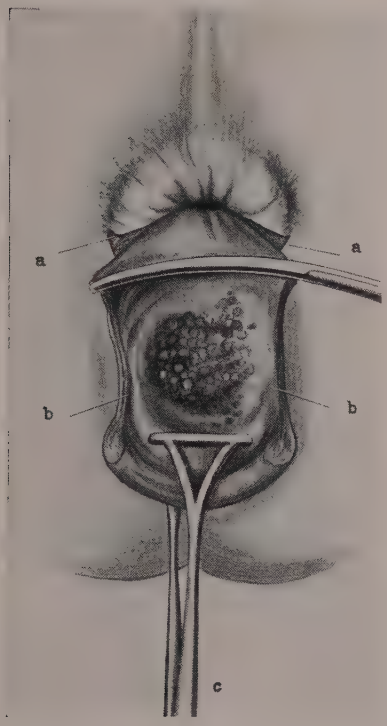


Fig. 4347.—Ball's Partial Perineal Proctectomy with Preservation of Sphincteric Action – I: – a, a, Curved incision surrounds the outer aspect of the anus corresponding with the involved portion of the rectum – following which two vertical incisions, b, b, are made upward. The outlined portion of the rectum is drawn down, c – clamped above the growth – and divided.



Fig. 4348.—The Same – II; – Following excision of the malignant area the margins of the mucosa are sutured to the skin and to the anus.

growth can be sufficiently protruded through the rectum to be thus liberally excised, argues, as a rule, that no infiltration of surrounding tissues has occurred – and that success may be anticipated in a large number of cases.

EXCISION OF THE RECTUM BY THE PERINEAL ROUTE

ALLINGHAM'S TECHNIC

This is one of the methods of excising the rectum long and extensively practised. The left index-finger is introduced into the rectum, and, with this as a guide, a long, straight bistoury is inserted into the median line, just posteriorly to the anus, and is carried through the postrectal tissues, including the muscular diaphragm of the pelvis, parallel with the rectum, and outside of it, until above the level of the growth – and then, at one sweep, is made to cut its way backward through all the intervening tissues, to the sacrum and coccyx – in its withdrawal, cutting everything between the point of entry and the tip of the coccyx, at one stroke of the dorsal incision, and to the full height to which it had been thrust (Fig. 4349). The wound is at once temporarily

packed with gauze to arrest bleeding. If the growth be of such nature as to necessitate the sacrifice of the anus and sphincters, the anal orifice is surrounded by an oval incision, passing into the connective tissue which will communicate, posteriorly, with the median incision. Then, using a pair of long stout scissors, one blade of which, at least, is sharp-pointed, one blade of the scissors is carried into the deep posterior wound, and the pointed blade, guided by a finger in the rectum, is thrust deeply into the ischiorectal fossa, first of one side, and then of the other, and made to cut away the laterally placed cellular tissue intervening between the blades. Similarly, but more carefully, because of the greater importance of the structures, the rectum is freed upon its two anterolateral aspects – while the sides of the wound are well retracted. Gauze packing is immediately thrust into each cavity as it is made. The anterior aspect of the rectum is dissected away with especial care – guided by a sound introduced through the urethra, in the male, and a finger in the vagina, in a woman. The freed rectum is then clamped and divided



Fig. 4349.—Allingham's Incision in Perineal Proctectomy.

distally to the clamp. All bleeding vessels are ligated. The divided end of the rectum is anchored into or as near the original site of the anus as possible.

If the growth be sufficiently far above the anus to warrant its preservation, along with the sphincteric apparatus, then the two limbs of the elliptic incision are not carried entirely around the anus, but leave a peninsula-like connection with the main perineum anteriorly – as seen in Fig. 4350. In such cases, then, as this method can be carried out, the growth is isolated and excised, well above and below it – and the upper limb of the rectum, well mobilized, is brought down and anastomosed with the anal end of the rectum – after which drains are inserted, and the posterior median and the two lateral elliptic limbs of the wound are sutured.

In those cases in which no part of the anal canal can be saved, but in which, nevertheless, the external sphincter can be preserved, the elliptic incision which surrounds the anus is placed between the external and internal sphincters – so that the divided rectum can be brought down and so sutured into the

former site of the anus as to offer the chance of some degree of sphincteric control. If the end of the rectum will not reach the perineum, the intervening tract is left to granulate.

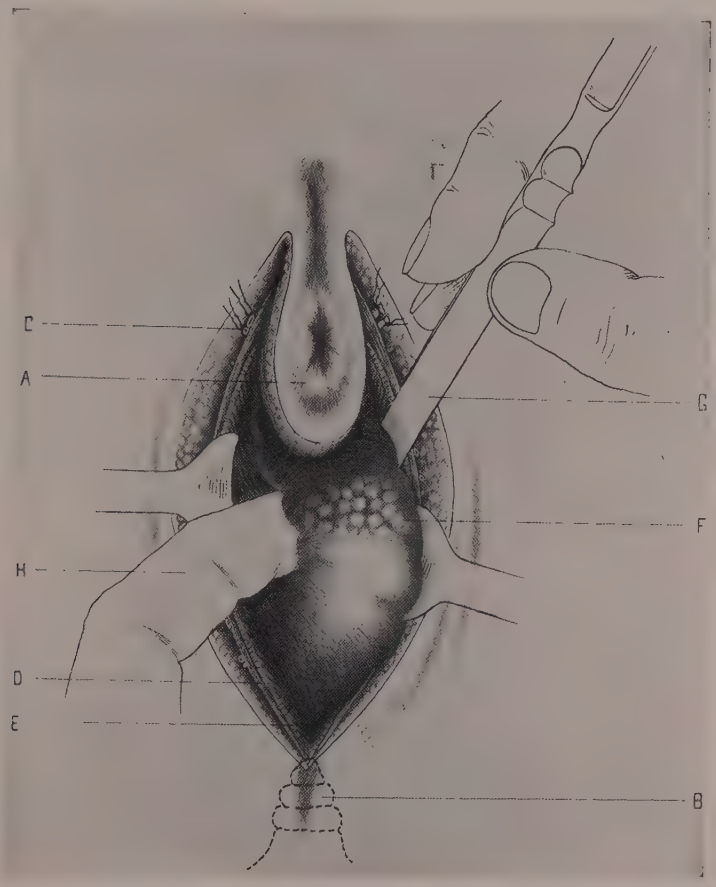


Fig. 4350.—The Same—II;—Freeing the rectum:—A, Anus;—B, coccyx; C, margin of wound, showing transverse perineal vessels anteriorly, and inferior hemorrhoidal vessels posteriorly; D, external sphincter; E, levator ani;—F, rectum being freed by blunt dissector (G) and by traction with finger (H)—(cancerous growth is shown at roughened portion of rectum). The anal outlet is being preserved.

Comments.—This type of operation does not afford as satisfactory means of removing lymphatics as do some of the others.

EXCISION OF THE RECTUM BY THE PERINEAL ROUTE

CRIPPS' TECHNIC

This, like Allingham's method, has been largely employed—but, like it the procedure does not admit of as thorough technic as do some of the other methods.

The operation is conducted largely, as is Allingham's—except that in the present instance the straight bistoury is introduced into the rectum, and is then made to cut its way out, in the posterior median line, severing, at one stroke, all the tissues intervening between the inner aspect of the posterior

rectal wall and the tip of the coccyx – the knife being introduced as high as required, and cutting backward into the hollow of the sacrum and coccyx. After the posterior median incision has been made, the rectum is freed by lateral incisions carried elliptically around the anus, and as high into the ischiorectal fossæ, and anteriorly, as indicated. These secondary lateral incisions are made boldly, with scissors – and all bleeding is controlled by gauze packing and by ligature. Especially must the freeing of the rectum anteriorly be carefully conducted not to harm the adjacent important structures – a sound in the male urethra and a finger in the vagina greatly aiding to these ends.

If the anus and external sphincter must be sacrificed, the excising incision includes these – otherwise it may be carried between internal and external sphincters – or, as the rectum has been laid open, an incision may be carried through the mucous membrane above the sphincter.

Finally, the rectum is divided above the tumor by means of a wire écraseur or by galvanocautery. If there is any chance to bridge the interval between the end of the rectum and the anus and its sphincter (if left), this is done, and an anastomosis made. If the anus have been sacrificed, an attempt is made to anchor the end of the rectum as nearly as possible in its original site. If the rectum cannot be brought to the perineal surface, it is anchored as near it as possible – and the intervening distance left to heal by granulation.

EXCISION OF THE RECTUM BY THE VAGINAL ROUTE WITH PRESERVATION OF THE ANUS AND SPHINCTERIC APPARATUS

MURPHY'S TECHNIC

Description.—This operation is especially indicated in those cases of rectal cancer occurring in the female, in which the vaginal wall is also involved.

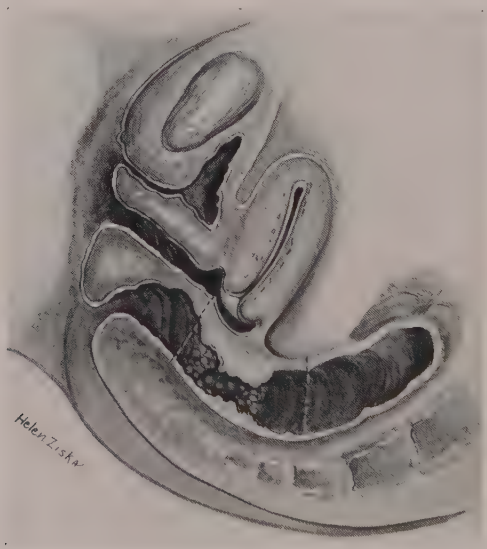


Fig 4351.—Vaginal Proctectomy; – Limits of the rectum to be removed in malignant growth opposite the cervicovaginal junction. The lower section is represented too near the growth.

Further than this, however, it has also been applied to cases of rectal cancer in women, independently of involvement of the vaginal wall. Formerly, the

method was only employed where the tumor involved the mid and lower aspects of the rectum – but subsequently came to be used in tumor of not only any part of the rectum, but even of the lower sigmoid colon. In Fig. 4351 is represented its application to a tumor involving the entire circumference of the rectum opposite Douglas' *culdesac*.

Operation.—The patient is placed in the lithotomy position and the vaginal walls well retracted, by broad retractors, while, at the same time, the cervix uteri is seized with vulsellum-forceps and drawn down to the vaginal outlet. A curved transverse incision is made in the dome of the posterior vaginal fornix just above the cervix (Fig. 4352). This incision opens up the peritoneal

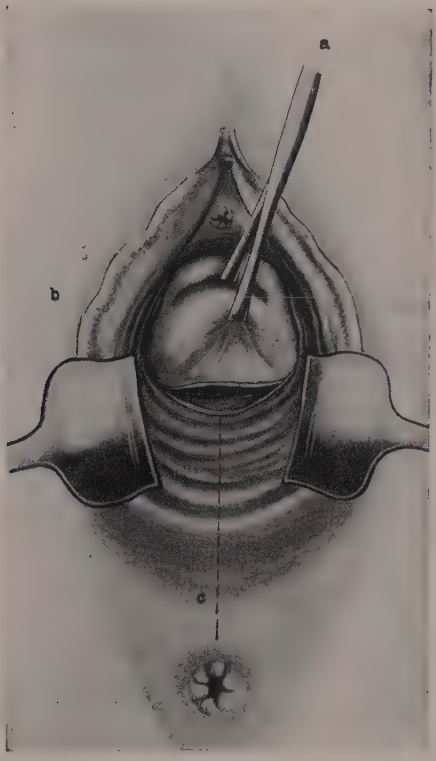


Fig. 4352.—Excision of the Rectum by the Vaginal Route (Vaginal Proctectomy) with Preservation of the Anus and Sphincteric Apparatus – Murphy – 1; – The vaginal fornix has been opened by a transversely curved incision – and the incision of the posterior vaginal wall and perineum is shown in the dotted lines.

cavity – which is packed with counted and taped laparotomy pads, to hold the small intestine upward and backward, out of the opening.

If the vaginal wall is not included in the growth, and if the anus need not be removed, a straight median incision is made down the posterior wall of the vagina, from the center of the transverse incision in the fornix. This incision passes over the vaginoperineal junction, and straight on over the midperineum to the external sphincter.

This incision through the rectovaginal septum is deepened well into the connective-tissue plane, and, through it, the rectum is mobilized in its entire circumference freeing the posterior vaginal wall from the anterior rectal wall

_ and the sides and back of the rectum from their connective-tissue bed by combined blunt and sharp dissection. The anterior rectal wall is now divided axially, through its median aspect, up to the lower border of the tumor (Fig. 4353). The anal aspect of the rectum is then separated from the tumor by complete transverse section at a distance of from 2.5 to 3.8 cm. (1–1½ inches) below the lower limit of the growth, the severing incision passing into the post-rectal areolar tissue. The proximal end of the divided rectum is seized with T-shaped clamps, whose blade is wide enough to entirely close its end (which is not the case in the illustration quoted _ Fig. 4354). Using this clamp as a

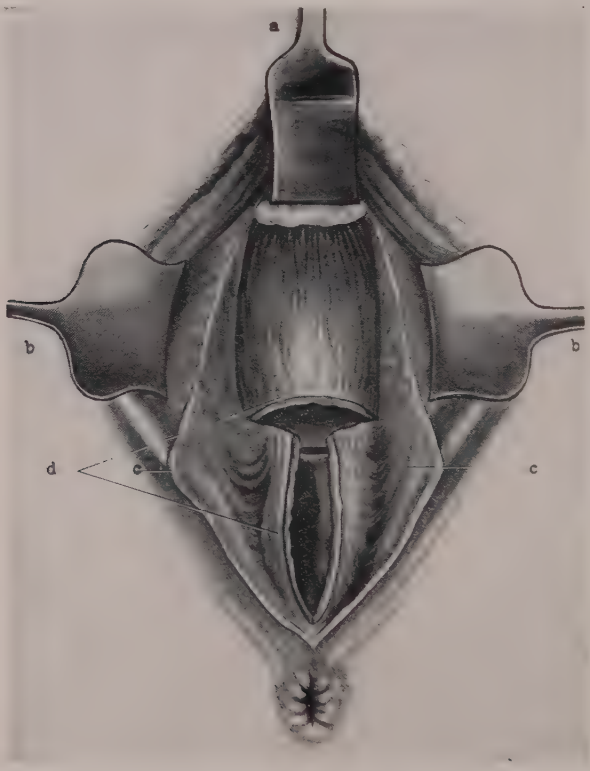


Fig. 4353.—The Same _ II: _ a, Retractor in peritoneal cavity, into which gauze pads have been inserted, to hold back the intestines; _ b, b, retractors separating the vaginal walls; _ c, c, rectovaginal flaps resulting from deepening the median incision and freeing the rectum; _ d, T-shaped incision through the anterior rectal wall, the horizontal portion dividing the rectum circularly 2.5 cm. (1 inch) or more below the growth.

tractor, and with a pair of curved Mayo scissors the divided rectum is freed from its coccygeal and postrectal attachments. It is at this junction of freeing the rectum from its bed that bleeding is most marked. All vessels are at once clamped, and between ligation and temporary gauze packing of the wound hemorrhage is entirely controlled. The mobilization of the intestine is continued as far up the sigmoid as may be necessary to enable the healthy part of the bowel to be displaced downward as far as indicated. The rectum is now doubly clamped and completely divided at a level of 3.8 cm. (1½ inches) above the highest limit of the disease.

The intestinal canal is now restored by suturing (Fig. 4355). The lower end of the sigmoid is drawn down and circularly sutured to the upper end of the sphincteric segment of the rectum _ constituting end-to-end sigmoido-rectostomy. Interrupted silk sutures are used, and these are introduced from within outward _ and are tied from within the bowel, after which the long ends of the sutures are passed through the anus and left on the outside, so as to aid in their subsequent removal. The anterior incision in the anal segment of the rectum is similarly united with interrupted silk stitches introduced from within the bowel, and brought out of the anus. If the external sphincter have been divided, it is now repaired by buried catgut stitches. The gauze

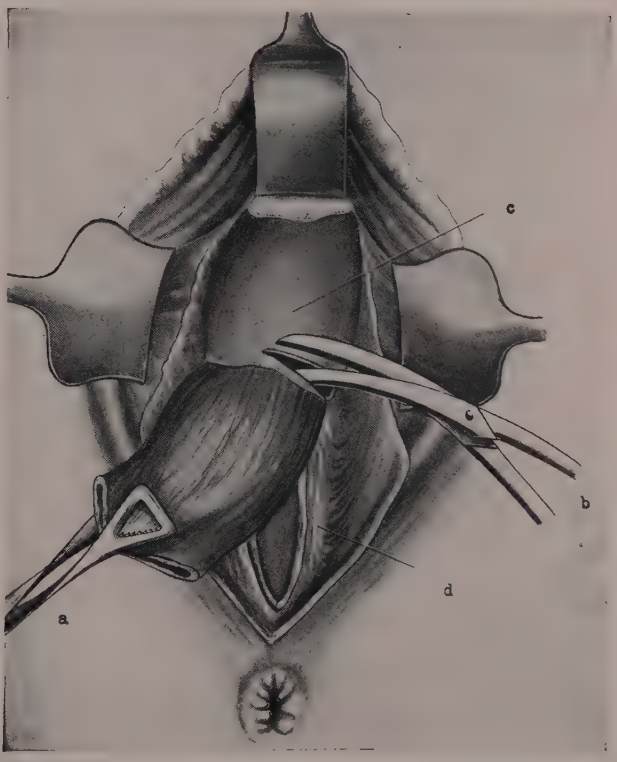


Fig. 4354.—The Same _ III: _ a, Tractors seizing the distal end of the diseased portion of the rectum; _ b, curved scissors severing the diseased portion (here, just above the peritoneal line) well above its upper limits; _ c, proximal end of the normal rectum, freed, together with the sigmoid, from as much of its bed as necessary, by blunt dissection; _ d, distal end of the sphincteric portion of the normal rectum.

pads are withdrawn from the peritoneal cavity, and the peritoneal opening closed by continuous suturing with catgut. The transverse wound in the fornix of the vagina is closed by suturing the vaginal margin to the cervical margin of the incision. Finally, the median vaginal incision is closed by silkworm sutures carried deeply through the sides of the vaginal wound and made to include the perineal muscles. In concluding the operation a rubber drain 2.5 cm. (1 inch) in diameter is passed into the rectum and held in place by a suture or two.

In those cases in which the vaginal wall is included in the growth, and the anal canal, anus, and sphincter have to be sacrificed because of involvement.

the vaginal incision becomes elliptic (instead of a straight cut) – and the anus is surrounded by an incision at the lower end of the perineal incision – these modifications of the originally described ones above not being a part of the Murphy technic, but necessitated by the needs of the individual case.

Comments.—The modifications of the Murphy technic, suggested by Tuttle, are the following: – The possibility, though not the invariable carrying out, of a preliminary colostomy, – to avoid soiling the wound at the time of

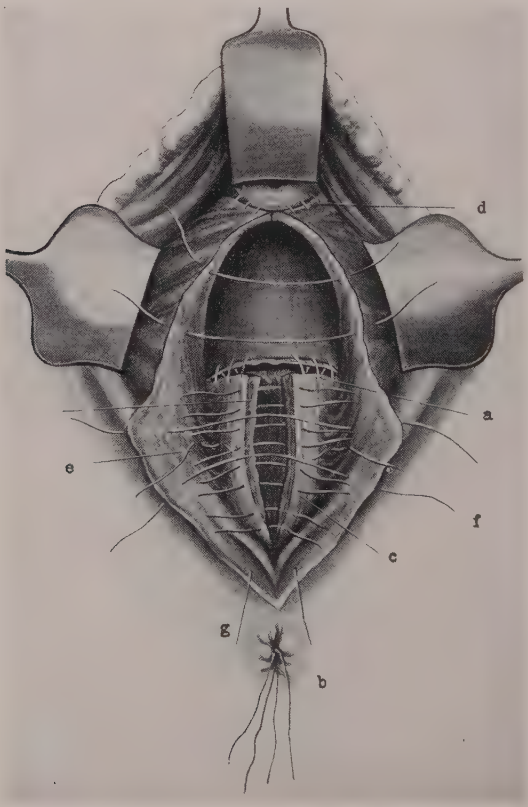


Fig. 4355.—The Same – IV; – The sigmoidal and sphincteric ends of the rectum are united by silk sutures, a, placed and tied from within, with the free ends brought out of the anus, b. The anterior rectal incision is similarly closed, c. The peritoneal opening is closed by continuous suture – and the transversely divided vaginal fornix by suture of the vaginal to the cervical mucosa, d (this last suturing hiding the peritoneal sutures). Superficial and buried vaginal and perineal sutures, e and f, unite these structures. The external anal sphincter is closed by buried suture, g. All sutures are interrupted, though not so shown here.

operation, – the beginning of the operation by a semicircular incision between the anus and the coccyx, the dissection from which is carried into the retro-rectal space, and, through this the rectum is freed from its posterior attachments, from the sacrum and coccyx, and the posterior lymphatic structures are removed, – and drainage provided. Then, when the vaginal part of the operation is performed, the bowel is not divided until after all its attachments are freed, dragged down as far as necessary, and the peritoneal cavity closed. He suggested the substitution of chromic catgut for silk in the bowel sutur-

ing. He advised reserving the operation for cases in which the vaginal wall is involved.

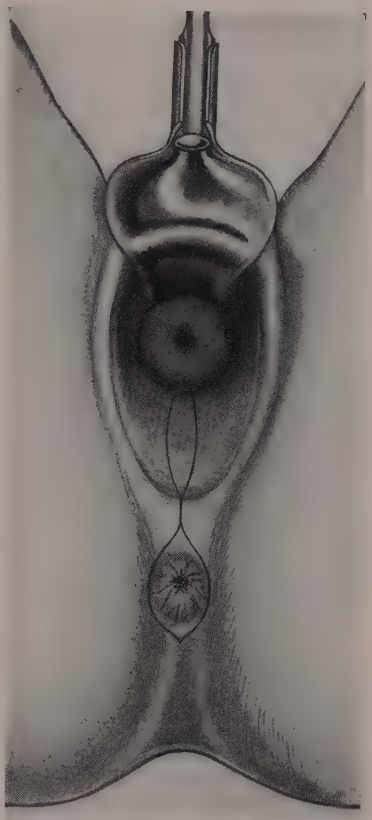


Fig. 4356.—Excision of the Rectum Through the Vaginal Route; – A straight incision along the vaginal floor being employed, ordinarily – and an elliptic one, as here shown, in cases where the vaginal wall is adherent to the growth – and where the anorectum must be sacrificed. (Not a part of the Murphy technic.)

Figure 4356 illustrates the incision of approach in the female, in those cases where the floor of the vagina is involved.

EXCISIONS OF THE RECTUM BY THE SACRAL ROUTE, IN GENERAL

Kraske, having incised through the soft tissues vertically downward from the second sacral spine to the anus and bared the coccyx and left lower part of the sacrum, excised the coccyx – entirely divided the sacrosciatic ligaments and completely excised the left lower portion of the sacrum along a line curving from the left margin of the sacrum (on a level with the third sacral foramen) along the lower border of the third sacral foramen to the left inferior corner of the sacrum – and thus exposed and excised the rectum.

This operation subsequently became the basis of various modifications. Hochenegg, Bardenheuer, and others have extended the line of excision transversely across the entire sacrum on a level with the lower border of the third sacral foramen.

Heineke, Rehn, Rydygier, and others converted the partial excision into

an osteoplastic resection of the sacrum and coccyx – by a parasacral incision just outside of, and parallel with, the left border of the sacrum and coccyx, followed by a transverse division of the sacrum just below the third sacral



Fig. 4357.—Incisions and Bone Sections in Proctectomy: – a, b and c, d, Kraske's; – a, e, Hochenegg's

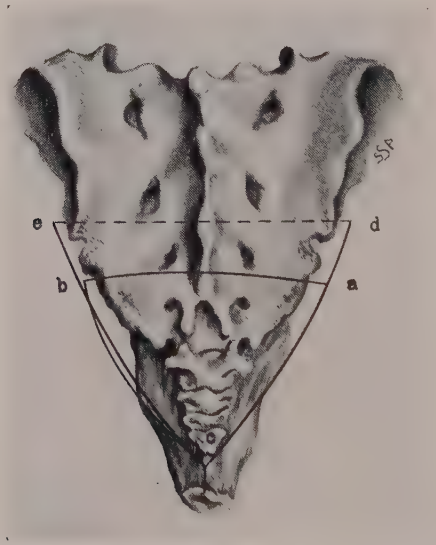


Fig. 4358.—Incisions and Bone Sections in Proctectomy: – a, b, c, Rydygier's; – c, d, e, Hegar's.

foramen – the flap thus formed being temporarily turned aside to the right, hinging upon its partly broken and partly bent tissues – and being subsequently replaced in position.

The section of the sacrum made in Kraske's original transsacral operation is seen in Fig. 4357, **a** to **b**, and **c** to **d**. Hochenegg's section is seen extending from **a** to **e**.

The sections of the sacrum in the Rydygier and in the Hegar osteoplastic procedures are shown in Fig. 4358.

Other methods of dividing the sacrum are seen in Fig. 4359.

The division of the sacrum as high as the lower border of the third sacral foramina may be performed without serious injury to, or serious functional impairment of, neighboring structures. But division as high as, and involving the third sacral foramina has been followed by paralysis of the bladder.

The special indication for the different operations of excision of the rectum by the sacral route is the presence of rectal involvement extending upward to

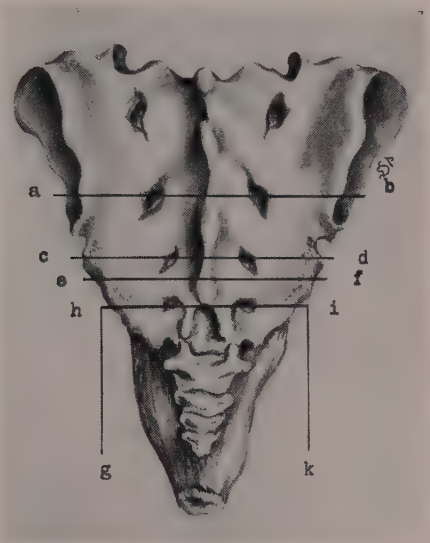


Fig. 4359.—Incisions and Bone Sections in Proctectomy: – a, b, Rose's; – c, d, von Heineke's; e, f, Bardenheuer's; – g, h, i, k, Levy's.

the middle of the sacrum – that is, this may be called a midroute, for the intermediate group of growths between the lowest, approached through the perineal route, and the highest, approached through the combined abdominal and perineal routes.

EXCISION OF THE RECTUM BY THE TRANSSACRAL ROUTE BY PARTIAL EXCISION OF THE SACRUM

KRASKE'S OPERATION

Description.—The Kraske operation, as usually performed, consists in the exposure of the postanal perineum, the coccyx, and lower half of the sacrum – followed by excision of the coccyx, and, if necessary, of the lower portion of the sacrum, extending below, but not involving the third posterior sacral foramina – and, through the opening thus secured, the excision of the involved portion of the rectum or rectosigmoid.

The chief field of application of this type of operation, along with other transsacral and parasacral forms of operation, is the presence of cancer involving the lower aspects of the rectum, and not extending beyond the middle of the

sacrum, although its extreme advocates have claimed for it an even larger field of usefulness.

A portion of the rectum may be excised and the opposite ends reunited, or the anorectum may be excised, and the lower end of the upper rectal segment be anchored to the skin.

Preparation.—The intestinal tract is thoroughly cleansed in advance, both by preliminary mild purgation, and by irrigations during the two or three days preceding operation. It is well to plan measures so that no bowel movement will take place for twenty-four hours in advance of operating. The perineum is shaved, and the patient comes to the table in antiseptic dressings of the part. The final cleansing and irrigation of the rectum and anoperineal region take place on the table. In these connections see Excisions of the Rectum, in General, p. 222.

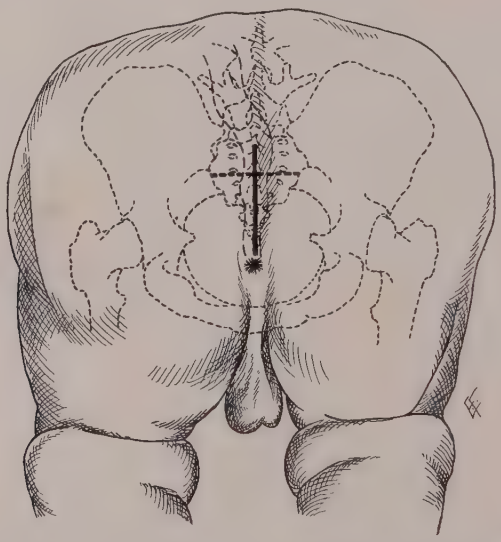


Fig. 4360.—Excision of the Rectum by the Transsacral Route.—Kraske;—The incisions—the solid, dark line representing the median perineal incision (from the second sacral spine to the posterior anal margin), and the dotted line, the bone-section (crossing transversely just below the third posterior sacral foramina). The patient is here seen in the Underwood kneeling posture, or in the suspended buttock position. The rectum and pelvic bones are outlined.

A preliminary left inguinal colostomy is performed by some Surgeons ten days to two weeks in advance,—thereby insuring greater cleanliness of the part during operation, and the avoidance of fecal soiling of the wound after operation. Some Surgeons begin the operation by dilatation of the anorectum.

Position.—The patient usually lies in the left lateroprone posture, with the buttocks well elevated upon a support, and projecting over the edge of the table, with the knees drawn up. Sometimes the patient is placed upon his back, with his thighs so forcibly flexed as to render the sacral region unusually prominent and directed somewhat upward, as the buttocks project over the end of the table,—but the Author has seen this extreme flexion of the thighs result in dangerously embarrassed respiration under anesthesia. Further, the patient is sometimes held in the knee-chest position by means of upright supports at the end of the table, being suspended from these from just below the hip-joints, while the chest is supported by a cushion. The lateroprone position is best.

Landmarks.—Anus; coccyx; sacral spines; posterior superior and inferior iliac spines; known course of the rectum.

Incisions.—Skin incision, – in the midline, from the second sacral spine, to near the posterior margin of the anus (Fig. 4360). Bone-section, – in the typical Kraske operation the bone is divided by a curved incision, with convexity upward and to the right, passing from the left margin of the sacrum,

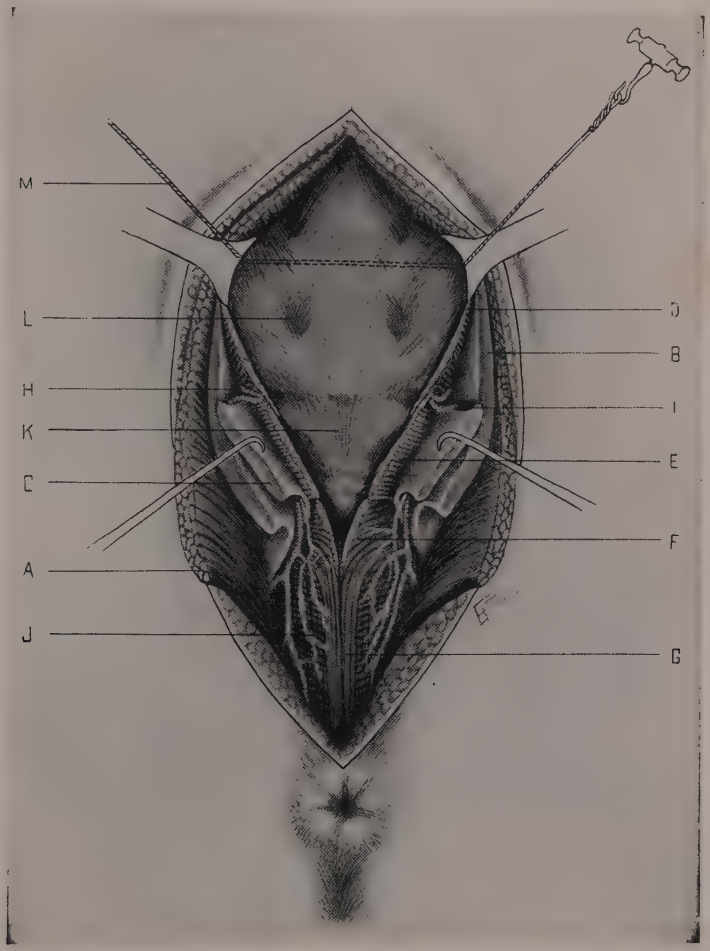


Fig. 4361.—Excision of Rectum by Sacral Route – Kraske Operation: – A, Gluteus maximus: – B, great sacrosciatic ligament; – C, lesser sacrosciatic ligament; – D, Pyriformis; – E, Coccygeus; – F, Levator ani; – G, external sphincter; – H, sciatic artery; – I, internal pudic artery; – J, Branches of internal pudic artery and pudic nerve; K, coccyx; – L, fourth sacral foramen; – M, Gigli saw dividing sacrum just below third sacral foramina.

just below the third posterior right sacral foramen, through the left fourth posterior sacral foramen, to end at the left lower corner of the sacrum. If excision of the coccyx alone will suffice to give necessary room, the sacrum is not divided. On the other hand, if more room be required than is given by the Kraske curvilinear section of the sacrum, a transverse division may be made as indicated in Figs. 4358 and 4359, provided it does not involve (cut

into) the third sacral foramina. As generally carried out, the sacrum is usually divided transversely, just below both third sacral foramina.

Operation.—The skin incision passes directly to the bone, over the middle of the sacrum and coccyx, beginning over the second sacral spine, and ending within about 2.5 cm. (1 inch) behind the anus. Vessels severed in this division are clamped and tied. The overlying soft parts are next retracted from the sacrum and coccyx, to either side. If it be considered that the excision of the coccyx alone will suffice, the sacrum is not so extensively freed at first – the coccyx alone being removed – otherwise the operation proceeds as follows:

The gluteus maximus and sacrosciatic ligaments are detached from both sides of the coccyx and sacrum – as well as the coccygei, and part of the pyriformes – hugging the margins of the bones closely, in both the sharp and blunt dissection (Fig. 4361). Pass a curved periosteal elevator beneath the sacrum –

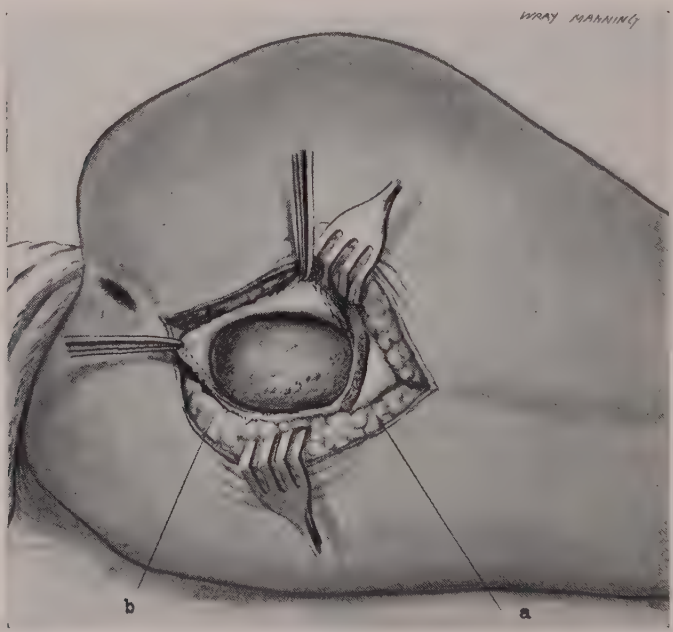


Fig. 4362.—Kraske's Sacrococcygeal Excision of the Rectum; – The site of the excised coccyx and of the partially excised sacrum are shown at a; – the margins of the incised connective tissue and musculature are retracted – exposing the rectum, b,

that is, in contact with its anterior surface – and detach the soft parts from the hollow of the bones, including the sacra media vessels, venous plexus, and lymphatics, along with them.

The coccyx and as much of the sacrum as considered necessary (up to the third sacral foramina) are now removed. To accomplish this, the soft parts are strongly retracted beyond the sacrum and coccyx, to right and left, and the sacrum transversely divided. This division may be accomplished in one of several ways. The section was first made by chiseling across the sacrum. Strong, bone-cutting pliers are frequently used. Both of these methods of bone-section are crude, as compared with the use of the Gigli saw, which is conducted beneath the sacrum and carried as far up as necessary to make the section, after laterally retracting the soft parts, and holding them out of the way of the saw with retractors, or a spatula, as the wire saw travels back and

forth. Such a section neither harms the anterior divisions of the third sacral nerves nor opens the sacral canal. The hemorrhage, which is chiefly from the lateral sacral, middle sacral, and hemorrhoidal arteries, and anterior and posterior venous plexuses, and the bone, is controlled by pressure, until the bone is removed – and, subsequently, by clamp and ligature.

Having thus exposed the pelvic cavity (Fig. 4362) the pelvic connective tissue is encountered, and is incised in the middle line, down to and through the junction of the levatores ani (anococcygeal ligament), until the rectum is reached. As soon as the levatores ani are separated by the median incision the retrorectal areolar tissue is entered, and this is freed from the posterior and lateral aspects of the rectum by blunt dissection (Fig. 4363) in an inward and upward direction, until the peritoneal reflection is encountered (Fig. 4364). The attachments of the peritoneum and mesorectum will prevent displacing

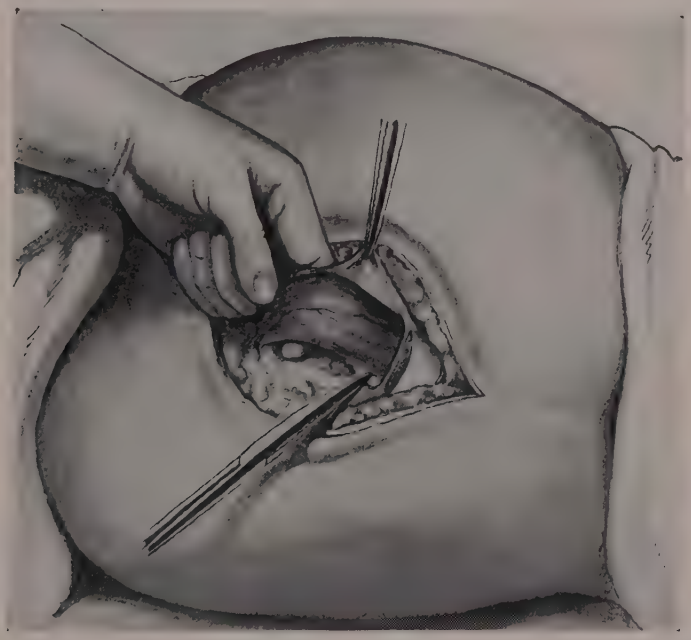


Fig. 4363.—The Same; – Mobilization of the rectosigmoid – after division of the sacrum.

the rectum very far downward. The peritoneal pouch is seized between two clamp-forceps, to the right, or uppermost aspect of the sacrum (in the lateral position of the patient) – and, after shifting the forceps from side to side, to see that no coils of small intestine are included, the peritoneum is incised to the outer right side of the rectum, and below the sacral division. The same maneuver is carried out upon the left side of the rectum – or, through the opening made upon the right, a finger is introduced and carried around the bowel, and, upon the finger-tip, protruding from within outward, against the peritoneum upon the left, that pouch is also opened. Unless a finger hooked around the rectum can readily deliver it into the wound, or an intestinal clamp accomplish this, it is well to conduct a gauze loop around the bowel and then clamp the ends of the gauze loop and retain it as a tractor. Indeed, even if the loop of bowel do not have to be delivered in this way, its use subsequent to delivery will prove helpful. The size of the rectum, enlarged

by tumor, may prevent the easy delivery of the structure. The two chief barriers to the delivery of a satisfactory loop of bowel are the lateral peritoneal reflections and the pelvic mesocolon _ and complete mobilization cannot take place until these are gradually divided, or separated as the operation proceeds. The peritoneal reflections not already divided are severed _ and the pelvic mesocolon is freed by combined sharp and blunt dissection as near to the sacral cavity as possible, so that the lymphatic structures will come away with the rectum *en masse.*

The peritoneal cavity is, exceptionally, not entered _ as seen in Fig. 4365.



Fig. 4364.—The Same: _ The involved parts in greater detail; _ a, a, Retraction of the margins of the medially severed skin, fascia, anococcygeal ligament, and levatores ani; _ b, sacrum divided at or near the fourth sacral foramina; _ c, convex posterior aspect of the rectum; _ d, bladder; _ e, vesicula seminalis; _ f, seminal duct; _ g, unopened (as yet) peritoneal pouch; _ h, gluteus maximus.

When the parts have been sufficiently mobilized, a loop of bowel is drawn well out of the wound, by means of the gauze tractor _ the lower part of the loop consisting of the rectum, and the upper part, of pelvic colon _ a sufficient length to provide for the spanning of the gap when the excision is made. Before the pelvic colon can be satisfactorily drawn down the superior hemorrhoidal artery must be tied and divided. It passes down in the mesentery of the pelvic colon and divides, opposite the third sacral vertebra (which represents the junction of the pelvic colon and rectum) into its two branches. It is doubly tied as high as possible toward the sacral promontory and above the anastomosis of the last sigmoidal artery by means of a ligature carried by an

aneurysm needle, or Reverdin needle, while guided by the left index. As much of the loop as desired can now be drawn down and delivered in the wound.

With the site of involvement, and the parts of the loop immediately proximal and distal to it brought within manipulation, the levels of the sections are to be determined _ and should, as a minimum, lie at least 3.7 cm. ($1\frac{1}{2}$ inches) to each side of the growth _ and further away, if possible _ and this is usually

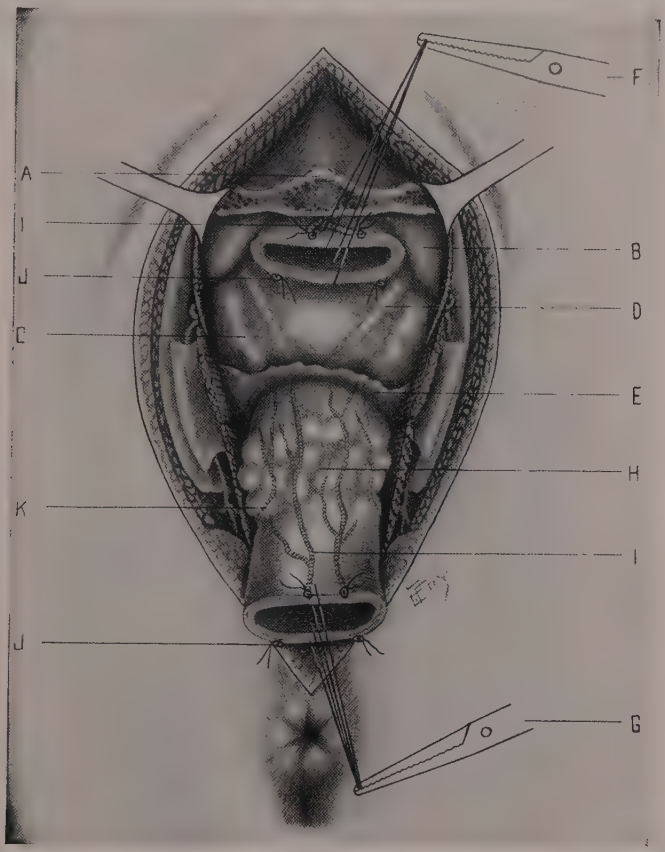


Fig. 4365.—The Same; _ Part of sacrum and coccyx removed and divided rectum turned down; _ Unlettered structures are same as in Fig. 4361: A, Section of sacrum below third sacral foramina; _ B, peritoneum; _ C, vesiculæ seminales; _ D, vasa deferentia; _ E, rectovesical layer of pelvic fascia; _ F, upper end of severed rectum; _ G, lower end of divided rectum retracted downward; _ H, cancerous growth of rectum; _ I, I, middle sacral artery and branches; _ J, J, superior hemorrhoidal arteries; _ K, middle hemorrhoidal artery (and same on opposite side).

possible if mobilization be freely made. A stout ligature is very tightly tied a short distance above (proximally to) the growth. A second ligature is tied still higher upon the proximal side of the tumor snugly enough to prevent intestinal flow. The bowel is then divided between these two ligatures (Fig. 4366) _ the short lumen of each end cleansed, disinfected with pure carbolic, wrapped in gauze, and clamped. The proximal end is temporarily laid aside.

The further separation of the distal segment from its surrounding structures, chiefly those in front of it, is now undertaken _ while the end of the

bowel is drawn downward. This separation is mainly carried on by blunt dissection, guided, in the male, by a sound in the bladder, while detaching the rectum from the prostate and bladder – and, in the female, by an Assistant's finger in the vagina, in detaching the rectum from the vagina – hemorrhage being controlled by pressure or ligature. The middle hemorrhoidal arteries hold the rectum laterally, and are exposed, tied, and divided while the lower segment of the bowel is being drawn downward. When these are ligated and cut, the lower bowel segment will be free from the upper limit of the anal canal (the level of the levatores ani).

After it has been determined whether the sphincters and anus must be removed or not – and after determining whether the provided loop of recto-sigmoid will be long enough, when finally divided, to reach the site at which it will either be anastomosed with the lower segment or be anchored upon the

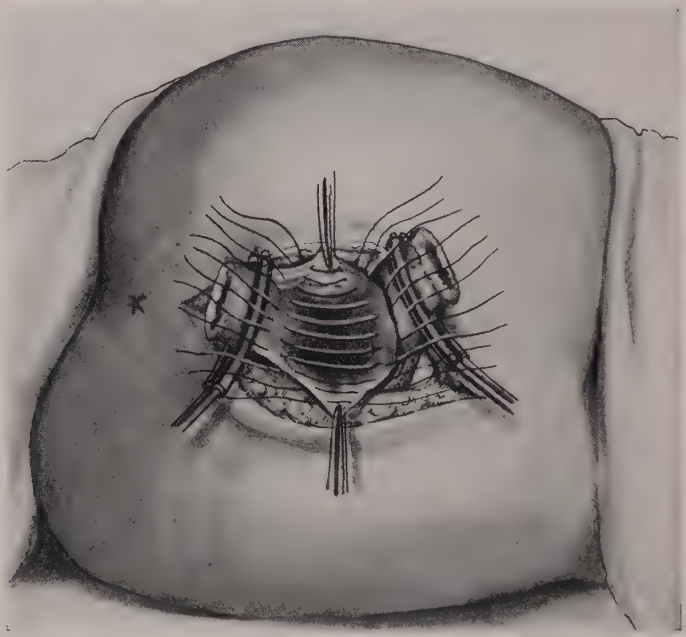


Fig. 4366.—The Same; – The proximal and distal ends of the bowel are clamped, and are being carefully drawn apart – while the opposite surfaces of peritoneum are being sutured together – so as to shut off the peritoneal cavity.

surface – and not until these have been decided – the opening of the peritoneal cavity is closed by suturing (with catgut) the margins of the divided recto-vesical, or rectovaginal peritoneum, to the anterior and lateral peritoneal surfaces of the bowel (Fig. 4366), thus shutting off the peritoneal cavity from the pelvic cavity.

If the lower segment of the bowel be found, following careful examination after division of its continuity, to be involved so far down as to make the preservation of the anorectal canal and orifice unwise, these are totally removed, in the same manner as in perineal proctectomy (v. p. 231) – the median perineal incision being extended forward to surround the anus.

Finally, the method of restoring the intestinal canal will depend upon several sets or combinations of conditions, – first, as to whether, or not, the sphincters and anus can be saved, – and, second, whether, in either of these

events, the distal end of the proximal segment will reach to the normal anal site. Each of these possibilities will be considered.

(*A*) If the Sphincters and Anorectal Canal be Retained, and the Bowel will reach the Anal Canal, several procedures are possible, among which are the following: — (*a*) In Kraske's technic the divided distal segment of bowel has already been ligated at its end between the site of section and the growth, before the first division. It is now divided below the growth. The distal end of the upper segment was lightly ligated just sufficiently to control the intestinal flow. This ligature is cut, loosening the bowel end. Provision is made to catch all soiling. The two ends are then brought together by end-to-end rectorectostomy and united by circular rectorrhaphy (Fig. 4367). This circular suturing is not easy, and several methods of application have been employed.

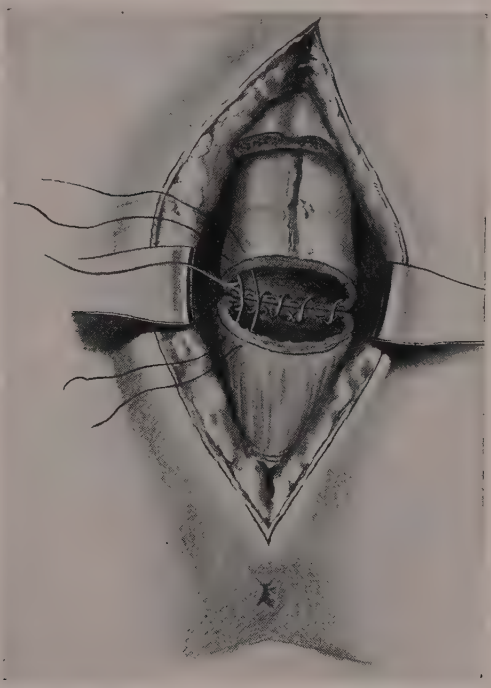


Fig. 4367.—The Same; — The anterior aspect of the margins of the bowel segments has been united by a tier of mattress-sutures and continuous suturing. A single layer of sutures is now uniting the posterior aspect — as this will be reinforced by a second tier.

Kraske sutured the anterior and lateral portions by a double tier of sutures, one through the mucosa only, and one through all the coats — while he inverts the posterior portion by a single tier, not passing through the mucosa. Edwards first sutures the fibromuscular layers of the anterior half of the circumference with silk — then the entire circumference of mucosa with twenty-eight day chromic catgut, tied within the lumen — and, finally, the posterior half-circumference of fibro-muscular coats, with silk. (*b*) Moulouguet carefully removes the mucous membrane of the lower segment of the rectum (avoiding injury to the external sphincter) — and draws the upper end through the lower portion, deprived of its mucosa (so that adherable surfaces are in contact), and sutures its borders to the borders of the denuded anus, controlled by its sphincter. (*c*) Terminal rectorectostomy has been performed by means of the

Murphy button _ but as one has, at most, but one segment of bowel surrounded with serosa, the result is often unsatisfactory.

(*B*) If the Sphincters and Anus be Sacrificed, with a Bowel End which may or may not be able to reach the former Anal site, _ some of the several procedures which have been adopted are the following: _ (*a*) If the divided bowel end will reach the original site, it is anchored in the wound, at that site, just as in perineal rectectomy (v. p. 231). (*b*) If the bowel end will not reach the original anal site, it is sutured into the upper angle of the perineal wound. (*c*) Gersunny twisted the bowel end upon its axis, through part of a circle,

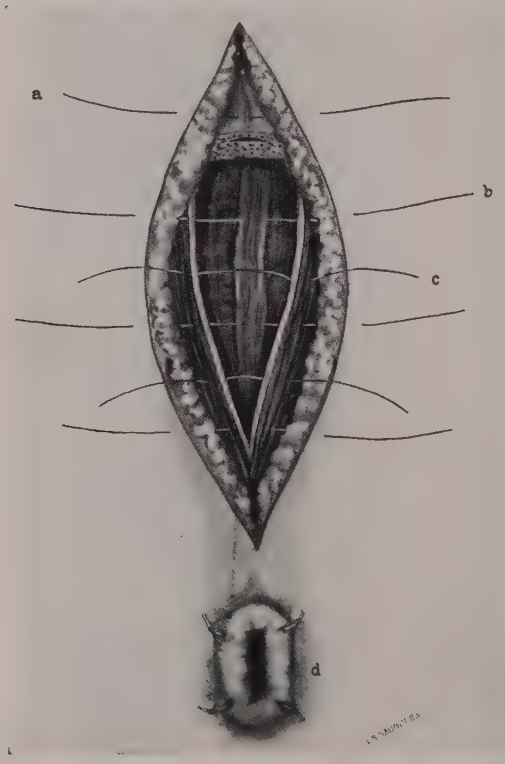


Fig. 4368.—The Same; _ Having excised the malignant section _ and sutured the freed upper end of the rectum to the distal portion of the rectum left just above the anus, or within the denuded anal ring, the posterior wall of the rectum is anchored in the wound: **a**, Suture of overlying soft parts to the fibrous tissue over the sacrum; _ **b**, non-penetrating sutures of the rectal muscularis to the overlying soft parts; _ **c**, sutures of the margins of the levatores ani; _ **d**, rectal mucosa stitched to the skin.

to add some barrier to fecal passage, and then anchored the end to the skin surface. (*d*) Witzel drew the bowel end through a short incision just above the free border of the gluteus maximus, and sutured its edges to the skin, thus gaining some muscular control.

In concluding the operation, the margins of the medially divided levatores ani are sutured together with chromic catgut (Fig. 4368) _ some of the stitches also anchoring the muscle margins to the outer coats of the rectum _ thus closing off the pelvic diaphragm. Before entirely suturing up the pelvic diaphragm a rubber drainage-tube is carried above the plane of the levatores, between two of the sutures, to pass out between the margins of sutured perineal

skin. A second drain may be passed into the purely perineal wound, below the level of the sutured levatores. A glass or rubber tube is anchored in the end of the bowel, or in the anorectal canal, to make the expulsion of gas or fluids easier. The superficial wound is closed with silkworm filament.

Comments.—Instead of suturing the opened bowel end into the perineal wound, where no junction with the former anorectal canal is made, the ligated bowel may be sutured in the site – the ligature preventing the soiling of the wound for two or three days. If distention occurs, short of necessitating the cutting of the ligature, the distending gas or fluid is sometimes drawn away by needle puncture of the protruding bowel.

Instead of adopting one of the above-mentioned methods, where the sphincters and anus are preserved, a very satisfactory procedure is to invert the mobilized distal segment (Fig. 4369) through the anal orifice (by carrying a pair of forceps through the anal canal and grasping the upper limit of the lower segment, and inverting it, as one does the finger of a glove). When the lower end of the upper segment is drawn through this, the serous surface of



Fig. 4369.—The Same; – The invagination and eversion of the ligated lower bowel segment through itself, preliminarily to excising the diseased portion of bowel, and anchoring the healthy portion, still invaginated and everted.

the upper and the raw surface of the lower segment will be in contact for union. Their surfaces are held in contact by a tier of sutures passing into (not through) the surface of the upper segment and the margin of the lower segment. A drainage-tube is tied into the end of the upper segment, which projects beyond the end of the lower inverted segment (Fig. 4370).

Where bleeding occurs at a time in the operation when it is difficult to expose and tie the vessels, this may usually be temporarily controlled by packing, until the vessels can be conveniently reached and tied.

In rare cases it is found possible to peel back the peritoneum sufficiently to give the necessary access and mobilization without opening the peritoneum – especially where it is not necessary to secure a considerable length of rectosigmoid to bring down.

It is easier to free the lower bowel segment from above downward, and there is less bleeding, in front, than from below upward.

Where it is known that the anal canal and orifice will be retained, it is considered best by some Surgeons to begin the operation by dilating the anus and subcutaneously dividing the sphincter – to secure rest of the sphincteric apparatus, and lessening of strain upon the suturing.

The danger of wound infection following these operations is the chief cause of failure to fully accomplish the desired ends – as well as of death itself – so that care should be used in proportion to the danger.

The superior hemorrhoidal vessels (bifurcating from the inferior mesenteric artery in the median line between the layers of the mesorectum) run very near the muscular layer of the intestine, and by cutting in the loose areolar tissue just under the peritoneum these vessels are avoided and the upper rectum easily freed from the wall of the pelvis. The high division of these vessels is apt to be followed by necrosis of the gut.

In the male, with empty bladder, the rectovesical peritoneal reflection is generally about 7.5 cm. (3 inches) above the anus. A full bladder raises the

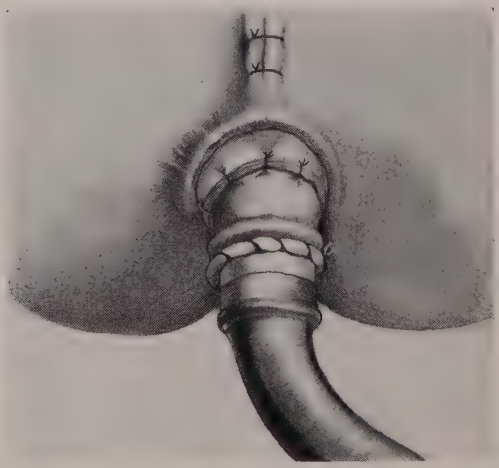


Fig. 4370.—The Same; – The lower end of the upper bowel segment has been drawn through the invaginated and everted lower bowel segment – after which the serous surface of the former has been sutured to the raw surface of the latter – the sutures penetrating the outer coats of the upper segment and all the coats of the free margins of the lower segment.

reflection about 2.5 cm. (1 inch). The tip of the coccyx is below the level of this reflection.

The peritoneum nearly entirely surrounds the rectum at the level of the third sacral foramen, a distinct mesorectum existing – loose areolar tissue connecting the intestine to the sacrum and coccyx where the peritoneum is absent.

A truss and pad are worn where a sacral anus is made.

EXCISION OF THE RECTUM BY THE TRANSSACRAL ROUTE BY OSTEOPLASTIC RESECTION OF THE SACRUM

REHN-RYDYGIER OPERATION

Description.—Very much that has been said of the Kraske transsacral excision of the rectum, and very much of the operative technic, applies in the present operation – the essential difference being the method of approach. In the former operation the lower part of the sacrum, together with the coccyx, is excised. In the present procedure the posterior bony covering, from below

the third posterior sacral foramina, is divided above and on one side, and temporarily turned to the opposite side – to be replaced at the end of the operation. The method, as is Kraske's, is especially applicable to tumors of the rectum not extending beyond the middle of the sacrum – although given a wider range by some advocates. Also see Excisions of the Rectum by the Sacral Route, in General, p. 253.

Preparation – Position – Landmarks.—As in Kraske's operation (p. 255). Unimportant variations upon the original procedure have arisen, as this method has developed, since its introduction, independently, by Rehn and Rydygier. The operation here described conforms, in the main, with Tuttle's method of carrying out the Rehn-Rydygier technic – Tuttle having preferred this to all other methods of operating upon the rectum by the sacral route. A preliminary inguinal colostomy is performed, if this procedure seems indicated.

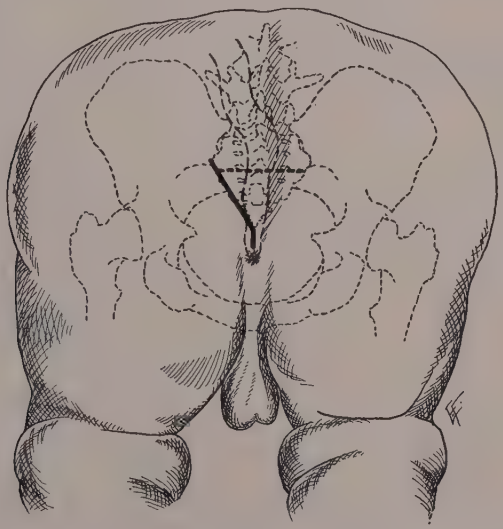


Fig. 4371.—Excision of the Rectum by the Transsacral Route, by Osteoplastic Resection of the Sacrum – Rehn-Rydygier – I; – The incisions – the solid, dark, parasacral line (from the level of the third sacral foramina, to the tip of the coccyx, and thence down the median line, to near the anus), as well as the dotted line below these foramina, represent the incision of the soft parts. The dotted line also represents the division of the sacrum. The patient is here seen in the Underwood kneeling posture, or in the suspended buttock position. The rectum and pelvic bones are outlined. The parasacral incision is shown on the left side, as originally practised.

Incision and Bone Section.—(*a*) The skin incision is first an oblique, right parasacral cut, beginning opposite the level of the third posterior sacral foramina (a little below the middle of the sacrum), and passing, thence, along the right border of the sacrum, to the tip of the coccyx – and, thence, in the median line, half-way to, or nearly to – the posterior aspect of the anus. The upper end of this oblique incision is carried transversely across the sacrum at the level between the third and fourth posterior sacral foramina (about 3.7 cm. or $1\frac{1}{2}$ inches above the sacrococcygeal joint), ending just beyond the left margin of the sacrum. (*b*) The bone section is made transversely across the sacrum just below the third posterior sacral foramina. The combined incisions are shown in Fig. 4371, in relationship with the rectum and pelvic bones (except that the transverse part of the incision should pass below the third sacral foramina). The skin incision, with the patient in position for operation,

is seen in Fig. 4372. In the former illustration, the parasacral incision is shown upon the left side of the sacrum (as originally planned by Kraske) _ though, ordinarily, it is made as a right parasacral incision, as shown in the latter illustration _ for the reason that the osteoplastic flap thus more naturally drops down, out of the way _ instead of having to be held up, out of the way.

Operation.—The anorectum is dilated, and the rectum again cleansed, and is then packed with gauze, or the anal orifice closed by suture. The patient is placed in the left lateroprone position, with the hips raised by a sand-bag. The right parasacral incision, beginning opposite the third sacral foramina, is boldly made along the right border of the sacrum and coccyx, through skin, muscles, and ligaments, into the postrectal areolar tissue _ the lower end of the incision being extended, in the middle line, nearly to the anus.

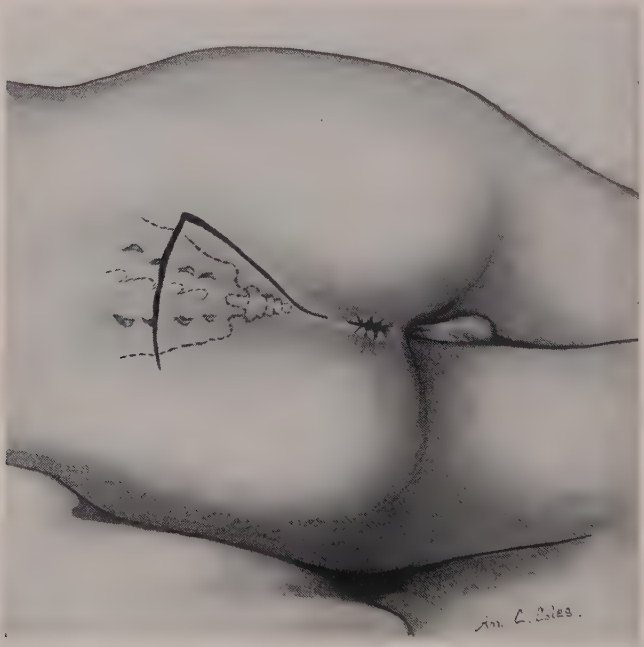


Fig. 4372.—The Same _ II; _ The position of patient and the incisions; _ oblique line of incision of the soft parts, along the right side of the sacrum to the tip of the coccyx, and, thence, in the median line, half-way to the anus; _ transverse line of division of the sacrum just below the third sacral foramina.

Gauze is temporarily packed into the deep, lateral wound, to control bleeding at this stage _ after separating the parts from the bone. The transverse incision is carried down to the bone, below the third foramina (Tuttle made the section at the level of the fourth sacral foramina) _ and the soft parts drawn upward and downward by retractors, preparatory to dividing the bone. This section of the bone was originally made by chisel and mallet _ but is more surgically accomplished by a motor-driven saw. Owing to the irregularities of the sacrum, the section may be carried nearly through the bone, and the rest of the bone be broken through, in the outward and downward turning of the osteoplastic flap. Before sawing, however, one should clear the anterior surface of the sacrum with curved periosteal elevator. As soon as the flap is turned down, better exposing the structures, the right lateral and middle sacral arteries are clamped and tied. These are the chief if not the only vessels of consequence

to be controlled throughout the operation, unless, inadvertently, the section is made so far outside of the sacral border that the right sciatic artery is wounded. The osteoplastic flap hinges along a line corresponding with the left sacrococcygeal border.

From this stage onward the steps of the operation may be carried out precisely the same, in every respect, as in the Kraske transsacral exposure by partial sacral excision – as have already been fully described (pp. 255–266).

On the other hand, the Tuttle technic, as to the soft parts, is as follows: – The pelvic diaphragm is incised in the median line and the rectum isolated, below the section of the diaphragm – after which it is controlled henceforth, in the manipulation, either by being grasped by special clamps, or by tying a ligature around the bowel, or by a gauze loop. If the tumor extends up any distance – or to mobilize the rectosigmoid sufficiently to enable the upper end

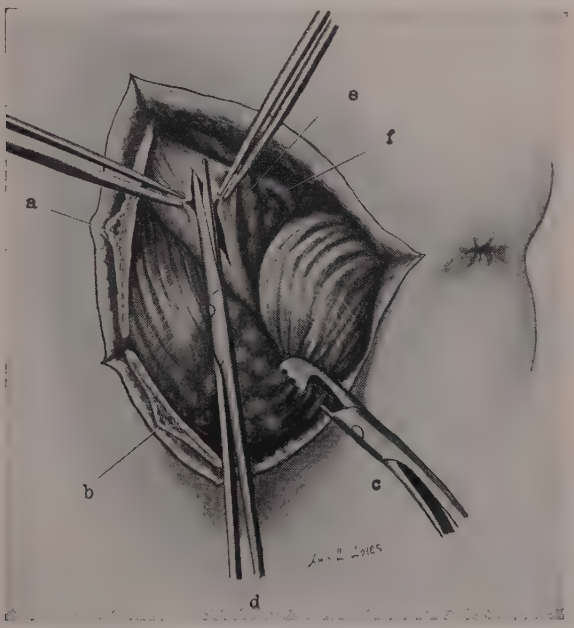


Fig. 4373.—The Same – III: – a, Proximal portion of the sacrum; – b, distal portion in the bone flap; – c, rectum, freed of the cancerous portion, being drawn downward and outward through the wound; – d, division of the peritoneum, laterally and anteriorly; – e, bladder; – f, seminal vesicle.

to be displaced downward for future anchorage, or anastomosis, the peritoneum must be freely opened. All the subsequent steps of the operation are made easier thereby. The peritoneal pouch, therefore, is seized by two forceps, to the right of the rectum, and incised with scissors (Fig. 4373). The peritoneum is thus cut upon both sides, and anteriorly, until the rectum is freed back to its mesorectum. The ureters are guarded during these steps. And while engaged in freeing the mesorectum the sharp and blunt dissection should be carried on as closely to the sacrum as possible, both to keep from wounding the superior hemorrhoidal artery, and to remove all lymphatic tissue from the hollow of the sacrum. In this way the rectosigmoid is mobilized sufficiently to be drawn down as far as necessary – certainly until several inches above the disease are brought down, and enough room, in addition, for anchorage, or anastomosis, is secured. When sufficient bowel is assured, the peritoneal

cavity is carefully closed — which is accomplished by suturing up the opening in each lateral pouch and then suturing the median portion of peritoneum to the anterior surface of the sigmoid, which has been drawn down into the opening. This closure of one of the pouches is shown in Fig. 4374.

The bowel is then either clamped or ligated on both sides of the growth, and at least 3.7 cm. ($1\frac{1}{2}$ inches) from it, both above and below it. The ligature is less in the way of the subsequent steps. The lines for such double ligation are shown in Fig. 4374, but are hardly far enough away from the growth. The field is protected from soiling by gauze packing. The bowel is then divided well above the disease — and the proximal end disinfected, lightly clamped, or controlled, and wrapped in rubber tissue. The lower bowel segment is then dissected free, from above downward — with the same precautions as mentioned under the Kraske operation (p. 255).

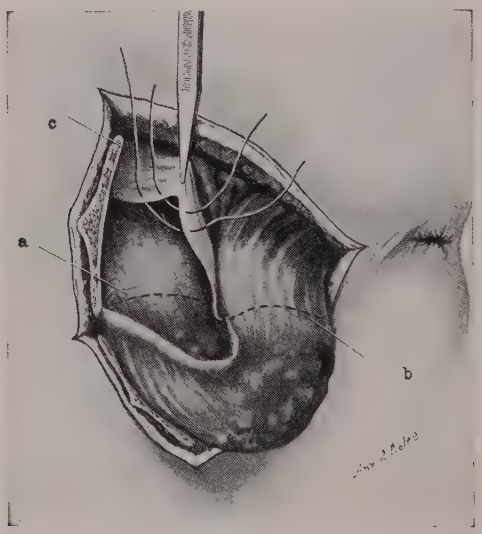


Fig. 4374.—The Same — IV; — Lines of proximal and distal section of the bowel; — Closing the peritoneum: — a and b, Line of proximal and distal divisions of the rectum, well above and below the cancerous involvement, shown in dotted lines. The opened rectovesical pouch is seen; — c, sutured closing of the general peritoneal cavity.

All the problems concerning the treatment of the distal segment of bowel, and the anchorage of the proximal end, or the anastomosis of the two ends, are the same in both the Kraske and in the Rehn-Rydygier methods — and, having been fully given in the former, will not be again detailed here (v. p. 255).

Tuttle advised, when as much as 2.5 cm. (1 inch) of healthy distal segment remained, to anastomose the proximal end with it by end-to-end suturing (Fig. 4375), stating that even though a posterior fistula almost invariably occurs, that it generally heals spontaneously. When less than 2.5 cm. (1 inch) of the distal segment remains, and it can be brought down sufficiently far, he advised dissecting the mucosa from this segment, and then drawing the proximal end through the distal and suturing it to the skin outside — not to the margin of the distal segment, but to the skin surface, entirely outside, so that this cornucopia-like opening out of the functioning end of the bowel will direct the feces away from the immediate wound. An anchoring, silk relaxation suture is carried through the mesorectum, about 7.5 cm. (3 inches) above the

anus, and through the skin, to relieve tension upon the anchored bowel. A rubber drain is anchored in the bowel.

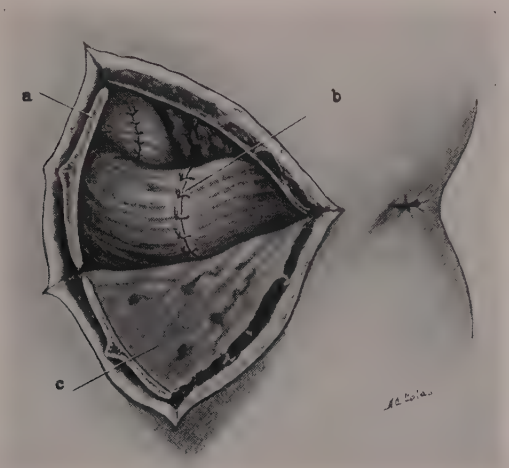


Fig. 4375.—The Same _ V; _ The peritoneum closed and the bowel sutured: _ a, General peritoneal cavity closed; _ b, the proximal and distal parts of the intestine sutured together; _ c, the composite flap, ready to be turned back into position.



Fig. 4376.—The Same _ VI; Closure of the parasacral wound, when the lower end of the divided rectum can be sutured to the anus. A tube-and-gauze drain is seen in the rectum _ and a tubal drain into the former bed of the rectum.

Finally, the pelvic diaphragm is closed by suture _ and the osteoplastic flap turned back into position. It is not necessary to suture the bone margins themselves, and necrosis is less apt to occur when this is not done _ but the

bony parts are held sufficiently in position by silkworm sutures which pass through the adjacent margins of periosteum and overlying ligaments. Last of all, the perineal wound is sutured. Provision is made for temporary drainage, which is generally necessitated by the considerable ooze sometimes present _ and this is accomplished by carrying a rubber drain between two of the sutures, both of the plane of suturing uniting the margins of the levatores ani and the plane uniting the perineal wound _ so as to drain both above and below the pelvic diaphragm. This drain is shown in both Figs. 4376 and 4377.

In those cases where no anastomosis can be made between the upper and lower segments, as well as in those where the proximal segment cannot even be anchored in the former site from which the anus has been excised, it may become necessary to create a sacral anus by anchoring the free end of the proxi-



Fig 4377.—The Same _ VII; _ Establishment of an artificial anus at the angle of the excised sacrum _ when the proximal end of the excised rectum cannot be safely made to reach the anus. A rubber tube drain is in the lower part of the wound.

mal segment to the skin at the angle of junction of the parasacral with the transverse incisions _ as shown in Fig. 4377.

Comments.—It sometimes happens that an operation begun as an osteoplastic procedure cannot be carried out as such _ in which case the semidetached bone is entirely excised.

Oozing may be so extensive, even before closing the wound, that a large gauze packing must be made into the hollow of the sacrum before suturing the osteoplastic flap in place _ the end of the packing being drawn out through an interval between the perineal sutures later.

EXCISION OF THE RECTUM BY COMBINED ROUTES, IN GENERAL

Excision of the rectum by the combined method signifies the exposure and removal of the structure by some combination of approach, one of which

is via the abdominal route. The primary approach, through the abdominal wall, is for the purpose of thorough examination, and for the proximal division of the intestinal canal. Through the secondary approach, in some portion of the vagino-perineo-sacral region, the lower aspect of the bowel is usually separated and removed.

Various combinations of approaches are employed _ such as the abdomino-perineal _ abdomino-anal _ abdominosacral (either by the abdominal route and excision of the lower part of the sacrum or by the abdominal route in connection with the osteoplastic resection of the sacrum) _ or the abdomino-vaginal. Of these, some form of combined abdominal and perineal operation is the procedure most usually carried out.

Further, these combinations of methods may be carried out in various stages. The abdominal, perineal, sacral, parasacral, or vaginal operations may be performed in one stage _ or the abdominal phase of the operation may be first undertaken, and the secondary operation several days later.

The especial indication for the removal of the rectum by the combined routes is cancer of the upper part of the rectum, or lower part of the sigmoid, or of the rectosigmoid. While this is the method of choice in high-lying cancers of the rectum and sigmoid, the technic is being more and more applied to a larger range of cases, because of the free exposure which it affords, first for the ocular and palpable determination of lymphatic distribution of the disease, and for lymphatic and vascular metastases (which are not otherwise obtainable), and, second, for greater thoroughness of manipulative technic in operation. Undoubtedly, many a patient has been operated upon by some non-abdominal route upon whom no operation would have been performed could the distribution of disease have been thoroughly determined in advance. And, of even greater importance, that many a patient would, undoubtedly, have been saved had abdominal exposure enabled a more thorough operative technic to be carried out. As a result of these facts there are some Surgeons who advise the almost universal adoption of abdominal exposure in some stage of the problem of rectal cancer. While its adoption as a part of every operation for cancer of rectum may be extreme, it is probably a safer course than to but rarely employ it. Here, as elsewhere, surgical judgment must be employed _ with a tendency rather toward than away from the combined operations. While there is greater primary danger to the patient in the case of the combined operations, there is greater danger of cancer recurrence where from imperfect removal only the lower route is adopted.

Operation by the combined route is more fatal in the male than in the female because of the anatomic relationships and the smaller amount of working room.

The abdominoperineal operation, which is the operation of choice by the combined methods, is sometimes carried out in conjunction with the establishment of a perineal anus, and sometimes with the formation of a permanent abdominal colostomy _ the final decision of which must depend upon the conditions of the individual case and upon the Surgeon.

Charles H. Mayo makes the following statements in the above connection: _ That colostomies and uncontrolled intestinal openings for fecal escape, whether they be abdominal or perineal, are very much alike, provided the sigmoid loop be destroyed in establishing the new opening _ for the reason that the left side of the colon is largely muscular and there is no functional restraint against bowel discharge after bowel contents have passed the splenic flexure _ and that, therefore, if a patient have no anal control and no sigmoid loop, he is much better off with an abdominal than with a perineal anus. But if the anus be removed and the sigmoid loop be retained, formed bowel move-

ments will be fairly controlled — but not liquid feces or gas. As against these secondary considerations, as important as they may be, nothing should be weighed as worth while to the patient which handicaps the Surgeon in influencing him to place the artificial anus in any site which can only be secured by sacrificing thoroughness in removal of all cancerous involvement.

The routes of dissemination of rectal cancer, as summarized by Anderson, as the result of work done by Miles, Handley, the Mayos, and other workers, are the following: — (*a*) Downward; either intramurally, in the wall of the rectum, distally to the growth, — or, extramurally, to the sphincter apparatus, to the connective tissues of the ischiorectal fossæ, and to the peri-anal cutaneous tissues; — (*b*) Upward; either intramurally, in the wall of the rectum, above the growth, — or extramurally, in the lymphatic vessels and gland of the sigmoid mesocolon, to the lymph structures in the direction of the bifurcation of the left common iliac artery, to the lymphatics of that site, and even higher; — (*c*) Laterally; to the presacral and precoccygeal structures, and, in the female, into the posterior vaginal wall, and, in the male, to the posterior sheath of the prostate gland — as well as, in both sexes, to the substance of the levatores ani and into the fascia covering their upper surface. The lymphatic dissemination may constitute an invisible intramural spread of the disease, as Handley has shown by the mucicarmin staining of cancer cells in process of mucoid degeneration several inches from the growth proper.

These extensive areas of lymphatic distribution are the indications for thoroughness of removal of all involved or suspicious tissues in operating for cancer of the rectum.

Vascular embolic dissemination of cancer to the liver is also encountered — and may be present even though visual and manual examination of the liver surface fail to make the discovery.

The operative technic by the combined routes will be given under the heading of several recognized procedures.

EXCISION OF THE RECTUM BY THE COMBINED ABDOMINAL AND PERINEAL OPERATIONS IN ONE STAGE—WITH THE ESTABLISHMENT OF A PERMANENT LEFT INGUINAL COLOSTOMY

Description.—The division of the rectosigmoid, the freeing of the upper end of the lower bowel segment, the closure of the pelvic peritoneum, and the establishment of the colostomy are accomplished through the abdominal wound, — and the final freeing of the lower segment and adjacent structures through the perineal wound.

The combined abdominoperineal routes are especially indicated in cancer of the upper rectum, or lower sigmoid, or of the rectosigmoid — as previously explained.

Preparation.—The entire gastro-intestinal tract should be prepared in advance — from the teeth to the anus — locally, and by the use of intestinal antiseptics — and this should be begun from ten to fourteen days in advance of operation.

The Abdominal Operation.—Through this, the general intra-abdominal examination is made — the division of the bowel proximal to the growth is carried out — the distal end of the proximal segment is anchored in the left inguinal region — the proximal end of the distal segment ligated and temporarily dropped beneath the pelvic peritoneal floor, which is closed over it — the secondary intra-abdominal lymphatic involvements removed, if necessary — and the main abdominal wound closed.

The patient should be placed in the Trendelenburg position, which will cause the bulk of the intestines to gravitate away from the site of operation.

A median abdominal section is made, from just above the symphysis pubis, to, or above the umbilicus, according to the thickness of the abdominal wall, and the difficulties likely to be encountered. When the abdomen is opened, the intestines are further packed off with abdominal pads – and the margins of the wound held apart by automatic abdominal retractors. A general intra-abdominal examination is made for extensions of disease – especially in the mesentery, the liver, and adjacent structures, and wherever lymphatic distributions or vascular metastases might be expected. Especially is the nature and extent of the local bowel involvement carefully examined. Upon this investigation will the feasibility, or otherwise, of the operation be determined – and the steps proceeded with, or terminated with closure of the abdomen.

In cases favorable for operation the first step consists in delivering the involved bowel segment into the field as well as possible. Usually the sigmoid colon is brought out, and the vascular supply of the part examined by holding the mesocolon against natural, or transmitted light, so as to learn the position of the vessels. Locate the beginning of the left iliac artery, and at about this level the inferior mesenteric artery can be recognized through the parietal peritoneum by its pulsation, as it descends from the aorta. At a distance of about 2.5 cm. (1 inch) to the right of the aortic bifurcation an incision is made through the parietal peritoneum, extending outward. On retracting the margins of the cut peritoneum, the inferior mesenteric vessels are exposed, doubly ligated between the superior and middle sigmoid arteries, and divided – thus leaving the superior sigmoid artery to supply the distal end of the sigmoid colon which will be used in the colostomy. In exposing the vessels the left ureter is brought into the field, and must be safeguarded.

The contents of the pelvic colon are now "milked" away, proximally and distally – after which the colon is compressed by two clamps, both applied proximally to the growth, and about 7.7 cm. (3 inches) from each other. In addition to the clamps two circular purse-string sutures are placed through the outer coats of the bowel, within the clamps, and well to either side of the site at which the intestine is to be divided. These are left loose. The sigmoid is then divided between the circular sutures by means of scissors – the cut extending somewhat into the mesentery – after which the ends of the intestine are cleansed, their free margins brought together by a continuous, through-and-through suture, and then invaginated by the previously placed purse-string suture. All bleeding vessels in the line of section are tied.

Instead of the technic just mentioned the bowel may be crushed where each purse-string suture would be placed – ligated in the crushed pathway – and the ligated ends invaginated – which is a somewhat simpler procedure (Fig. 4378). In either event both ends of the divided bowel are protected by gauze and clamped.

The rectosigmoid is now chiefly held by the peritoneal reflections (mesocolon) and the superior hemorrhoidal vessels. The superior hemorrhoidal vessels are exposed, tied, and divided, by extending the mesocolic incision posteriorly, to the parietal peritoneum. The mesocolic peritoneum is divided down each side of the rectosigmoid, near the reflection of the peritoneum from the mesocolon to the parietes, until the rectovesical, or recto-uterine peritoneal reflection in the pelvic cavity is reached, when the two parallel, lateral incisions are joined across the front of the rectum (Fig. 4379). In making these two incisions to free the mesocolon, care is taken not to wound the two ureters, especially the left, which is more exposed. While the upper end of the partially freed lower bowel segment is drawn forward, its posterior aspect is freed from the hollow of the sacrum and coccyx, from above down-

ward, by blunt dissection, hugging the bones. This maneuver is aided by a double fold of gauze stretched over two fingers. At this stage of the bowel freeing, the middle sacral arteries are tied. The rectum is separated, anteriorly, from the bladder, in the male, by blunt dissection in the connective-tissue plane between the two structures, hugging and preserving the seminal vesicles, vasa deferentia, and prostate _ and, in the female, from the uterus and vagina. In these separations, blunt dissection and division by Mayo scissors are carried on conjointly. The ureters must be constantly guarded, especially the left one.

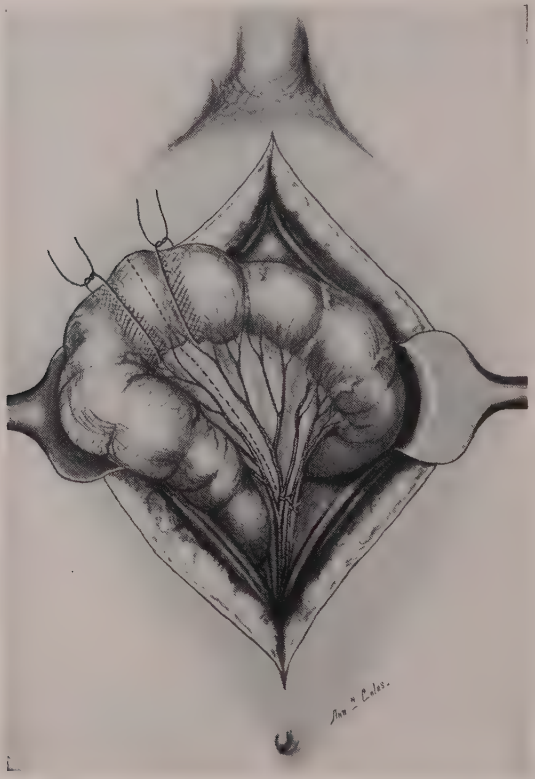


Fig. 4378.—The Same _ II; _ Illustrating the same features as the preceding, with ligature control of the sigmoid loop; _ The sigmoid colon and upper rectum have been delivered through a median abdominal section. The intestine has been crushed on each side of the site to be excised, and is being ligated through the crushed tract. A dotted line marks the division of the intestine and its mesentery. Ligature is seen on the branches of the inferior mesenteric artery supplying the parts to be removed. The patient is in the Trendelenburg position.

The middle hemorrhoidal vessels are tied and divided upon each side of the rectum. This freeing is continued down to the levatores ani _ and the more of the mobilization of the rectum that is accomplished from above, while the abdomen is open, the more thoroughly can it be done, and the less of it there will be to do, later, from the perineal aspect. The freed distal portion of the bowel is now depressed into the lower pelvis, and, if possible, the margins of the divided pelvic peritoneum sutured over it, thus shutting off the peritoneal cavity from the future perineal wound (Fig. 4380). This may be harder to accomplish in the male _ but which is facilitated, in the female, by tilting the

uterus backward and utilizing its posterior peritoneal surface in the closure. No traps for intestinal entanglement or protrusion must be left.

A left inguinal colostomy is now established – which, in the open condition of the abdomen, may be readily accomplished by a stab-wound through the abdominal parietes, through which the end of the proximal segment of the sigmoid is drawn, and anchored in the usual manner of a colostomy (v. p. 8). A rubber tube is then inserted through an incision made in the invaginated end of this piece of bowel, and the intestine is tied around it – the end of the tube being clamped to prevent leakage.

The median abdominal wound is now closed, in the usual manner, thus completing the abdominal phase of the operation.



Fig. 4379.—The Same – III; – The proximal end of the colon has been brought out through a left inguinal colostomy wound. The distal end, surrounded, at its division, with gauze, to prevent soiling, is being freed from its mesenteric and vesicorectal attachments.

The Perineal Operation.—Through this the rectum is finally removed. The patient is changed from the Trendelenburg to the left lateroprone posture, with elevated buttocks (or into the lithotomy position, according to the habit of the Surgeon, and dependent upon what form of perineal, or transsacral operation is contemplated). The perineal phase of the operation is conducted along the same general lines as is the independent perineal operation (v. p. 231) – except that, in the present case, it is a much simpler procedure, because of the division of the rectosigmoid which has already been made, and the large extent to which the distal bowel segment has already been freed through the abdominal wound. The more completely the lower segment has been freed – the lower the level to which it has been depressed – and the more completely

the peritoneal floor has been closed by suture during the abdominal phase of the operation, the easier will be the steps of the perineal operation.

The steps of the perineal portion of the operation have been described under the Quénu technic (v. p. 231), and, in a simplified way, apply here. An incision is begun over the base of the coccyx, and is continued, in the middle line, nearly to the posterior aspect of the anus, where the single incision deviates, on either side, to form an ellipse, embracing the anus, and meeting in front of it (v. Fig. 4332, p. 232). This incision is deepened everywhere throughout its course. The coccyx is exposed and excised. The levatores ani are separated by incision along their raphé, and their inner margins retracted. The fingers

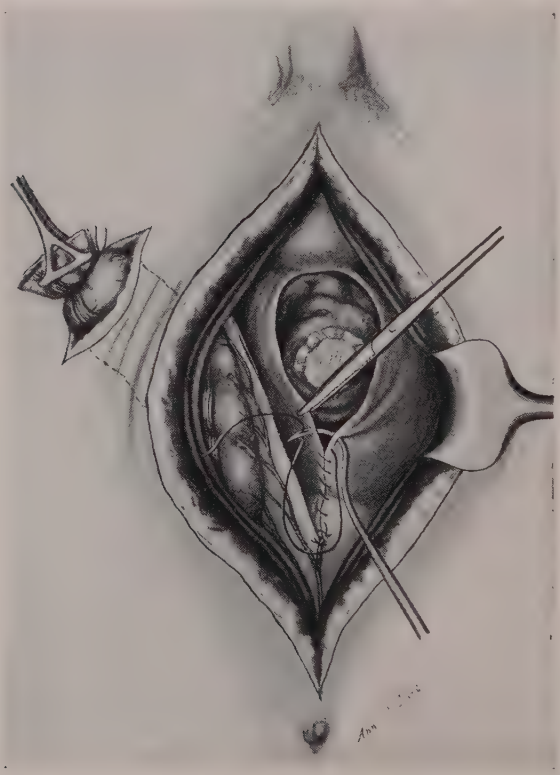


Fig. 4380.—The Same – IV; – The distal portion of the rectum has been depressed into the pelvis, to be removed immediately, through the perineum. The pelvic peritoneum is being closed throughout over the displaced bowel segment. The position of the left inguinal colostomy is shown (the end of the colon being here ligated, instead of invaginated).

or forceps are then introduced, and the free end of the rectosigmoid, already mobilized in its upper part through the abdominal wound, is seized and drawn down and out through the perineal wound – which is accomplished by blunt and sharp dissection, laterally, in the ischiorectal fossæ; posteriorly, from the few remaining connections; and, anteriorly, from the posterior aspect of the prostate (or from the vagina, in the female) – the freeing anteriorly being accomplished both from above, downward, and by incising upward from the perineal wound, at the central tendinous point of the perineum, thereby separating the structures in front of the sphincteric apparatus. The median aspects

of the levatores ani, having no longer any rectum to elevate, are sometimes excised and should always be so excised if there be any question of dissemination into their structure. When these steps have been accomplished, the separated rectosigmoid, with its attached lymphatic and other structures (including the sphincter apparatus), is removed through the perineal wound *en masse*.

If the middle hemorrhoidal arteries were not tied during the abdominal part of the operation, they are ligated during the perineal manipulations. If any gauze were packed down upon the detached bowel, before closing the peritoneum, in the earlier steps, this is carefully removed. Finally, the deep perineal wound is brought together by deep buried chromic catgut sutures, and superficial stitches of silkworm filament – with exception of the site occupied by the deeply placed rubber drainage-tube.

In those cases in which the invaginated distal end of the proximal bowel is anchored into the colostomy wound without immediately tying-in a Paul tube, this procedure is carried out within two or three days by incising the protruding, blind end of bowel.

EXCISION OF THE RECTUM BY THE COMBINED ABDOMINAL AND PERINEAL OPERATIONS IN ONE STAGE—WITH THE RESTORATION OF THE INTESTINAL TRACT

Description.—In this method of procedure thorough intra-abdominal examination is made, and the sigmoid colon is sufficiently mobilized through the abdominal phase of the operation to enable the rectosigmoid to be low enough displaced that, after free removal of the portion of the bowel involved by cancer, the remaining upper proximal portion can be brought down to, and be anastomosed with, the distal, sound remnant of the rectum – after which the pelvic peritoneum is closed over the downwardly displaced pelvic colon, and the abdominal wound closed. Then, through the perineal phase of the operation, the diseased part of the bowel is excised, and the junction between the two sound ends is made, or the distal end of the sigmoid colon is anchored at and within the anal orifice. The most important part of this operation next to removing the growth is satisfactory and safe provision for the blood-supply of the mobilized and shifted pelvic colon, which is sometimes uncertain. And the special indications for the adoption of the method is the presence of a sound and sufficient lower anorectal segment of bowel, so that only the portion must be sacrificed which intervenes between it and the sound sigmoid above.

Preparation.—As in the preceding method (p. 274).

The Abdominal Operation.—This is begun and carried on just as in the operation last described – up to the completion of the intra-abdominal examination. At this stage steps are begun simply to free the pelvic colon – rather than, as in the last procedure, to both free and divide it. The retention of this part of the colon in position is largely due to its blood-vessels – so that these have to be divided sufficiently to free the bowel – and, at the same time, a sufficient vascular supply must be retained to nourish the bowel. The superior hemorrhoidal artery (the continuation of the inferior mesenteric) is exposed above the sacral promontory, doubly ligated above the origin of the last sigmoid branch (left to supply the pelvic colon), and divided.

The pelvic colon is mobilized sufficiently to enable about 15.2 cm. (6 inches) of its length to be displaced downward, below the level of the underlying iliac vessels. This is accomplished by incising the parietal peritoneum down both sides of the pelvic colon, close to the mesocolon – the incision through the peritoneum crossing the colon in front, at the peritoneal reflection from the

colon to the bladder, in the male, and at the reflection to the vagina and uterus in the female. The pelvic colon is then detached laterally and posteriorly, sufficiently for its easy downward displacement. The loosened colon is then carefully pushed down into the pelvis, into the space between the levatores ani and the pelvic peritoneum _ after which the margins of the pelvic peritoneum are sutured together, and to the pelvic colon in the same manner as in the preceding operation (v. p. 274) _ thereby shutting off the peritoneal cavity and restoring the pelvic peritoneal floor. The abdominal wound is then closed.

The Perineal Operation.—The patient is now placed in the left latero-prone posture, and a median perineal incision made, extending from over the sacrum, nearly to the posterior margin of the anus. The steps of the first part of this phase of the operation are largely those of the preceding operation.

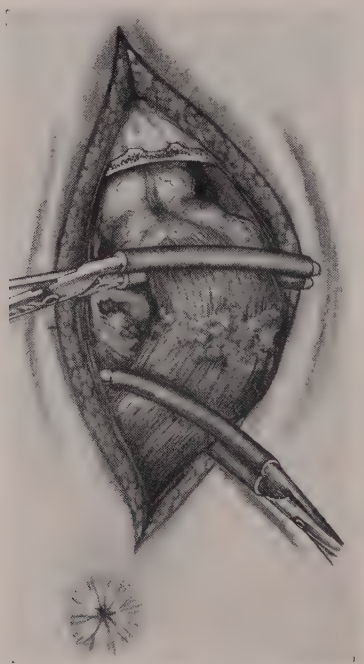


Fig. 4381.—Excision of the Rectum, by the Combined Abdominal and Perineal Operations, in One Stage _ with the Restoration of the Intestinal Tract _ I; _ The loop of rectosigmoid has been delivered through the perineal wound, and clamped above and below the growth.

The median incision is deepened _ the raphé of the levatores ani exposed and divided in the median line _ and, through this, access is gotten to the space in which the detached upper end of the bowel was left _ namely, between the sutured peritoneal floor of the pelvis and the upper aspect of the levatores. The coccyx is usually excised, in order to secure room for manipulation. The freeing of the rectum is carried on, upon its perineal aspect, up to its sphincter apparatus _ posteriorly, from its sacrococcygeal bed _ and, laterally, from the surrounding connective tissues. During the progress of this mobilization, the rectosigmoidal loop is drawn outward through the perineal wound, and forward _ and, in this way, access is gotten to its anterior aspect, where it is freed from the prostate gland, by working forward by access over its sides. This freeing is simply carried downward toward the anal canal until

the level of the bowel is reached at which it is to be divided, several inches below the growth, if possible. At this stage it is well to detach the mucosa from the lower part of the rectum, up to the level at which it will be divided. This is accomplished through the previously dilated anorectal orifice, just as is the Whitehead operation of excising the hemorrhoidal mucosa (v. p. 158). Calculating the level to which the upper part of the bowel is to be drawn down, a ligature is tied around it at a still slightly lower level, but still several inches above the highest extent of the growth (Fig. 4381). The rectum is clamped toward the anal end, just below the site at which it is to be severed. The intervening bowel, with its growth, is then divided below the ligature, and above the clamp by scissors, and removed. Forceps are now carried through

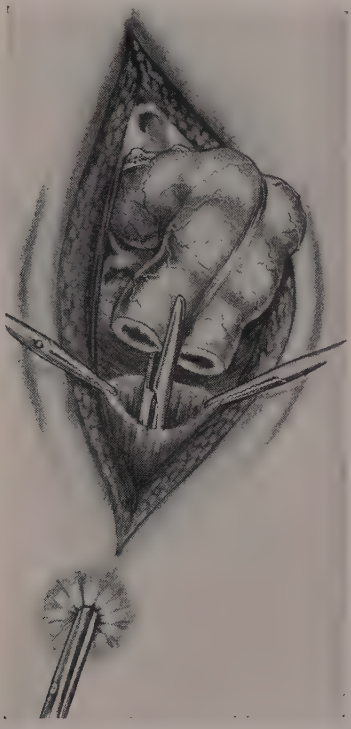


Fig. 4382.—The Same – II; – The excision of the involved part of the bowel loop has been made – and the end of the upper segment is being drawn through the anorectal canal, which has been denuded of its mucosa.

the anus, grasp the ligated end of the proximal pelvic colon (Fig. 4382) – and draw it through the anal orifice – thereby approximating the raw surface of the pelvic colonic segment above, to the mucosa-denuded lumen of the rectal segment below. The upper margin of the freed rectal segment is sutured to the surface of the pelvic colon by chromic sutures which penetrate all the coats of the rectum, but only the outer coats of the pelvic colon (Fig. 4383). At the anal orifice the lateral aspects of the colonic end are sutured to the denuded anal orifice by sutures which do not penetrate its lumen. The ligature placed upon the colon before its division is retained for two or three days, to prevent soiling of the perineal wound. If it must be opened sooner, or at once, a tube should be tied in the bowel, so as to conduct feces to a distance from the wound.

Finally, the divided levatores ani are repaired by suture to each other and to the sides of the pelvic colon _ and the perineal wound closed by deep chromic catgut and superficial silkworm sutures _ after placing a deep drain.

Comments.—When the rectum is excised and it is desired to bring down the sigmoid colon sufficiently low to be anchored within control of the sphincter apparatus, mobilization of at least the lower sigmoid colon is necessary _ and it may be freed even as high up as the splenic flexure of the colon _ by means of an incision through the parietal peritoneum, carried up along the outer

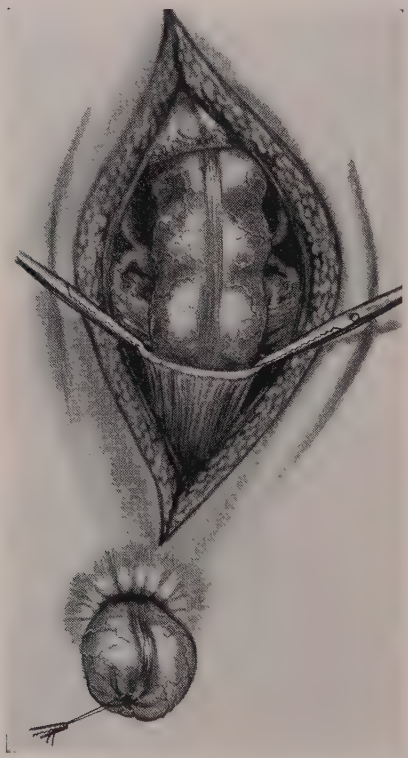


Fig. 4383.—The Same; _ Following excision of the involved portion of intestine, the distal end of the sigmoid has been drawn through the remaining mucosa-freed anorectal segment, and out through the anal orifice. The proximal end of the anorectal segment will be sutured to that aspect of the sigmoidal segment with which it comes into contact, by chromic catgut sutures, which will penetrate the margins of the latter and the outer coats of the former. The protruding end will be sutured to the margin of the mucosa-freed anorectal segment.

aspect of the descending colon. The mobilization of the rectosigmoid is also aided by the excision of the lymphatic and connective tissues. The chief restraint to the freeing of the pelvic colon, however, is the superior hemorrhoidal artery. This must be carefully exposed and severed between double ligatures, which should be placed above the last anastomotic sigmoid loop, as there is no positive dependence to be placed upon the anastomosis between the last sigmoid loop and the distal part of the superior hemorrhoidal artery (Taylor).

OTHER OPERATIONS FOR THE EXCISION OF THE RECTUM BY THE COMBINED METHODS

Mayo Tube Method of Directly Uniting the Sigmoidal and Rectal Bowel Segments in the Combination Method of Excision.—After having mobilized the sigmoid colon through the abdominal opening and completed that phase of the operation _ and excised the involved portion of the bowel through the perineal opening _ the ends of the sigmoidal and rectal segments are united directly by suture. This is accomplished by carrying a rubber tube (which also



Fig. 4384.—Mayo Tube Method of Directly Uniting the Sigmoidal and Rectal Bowel Segments in the Combination Method of Excision _ I; _ The tube, introduced from the anus, is being anchored within the lower part of the sigmoid, preparatorily to making the colorectal anastomosis _ the tube first serving as a tractor _ and then remaining in position as a temporary fecal drain.

serves as a temporary drain) from below, through the anorectal canal _ across the gap _ and a short distance into the sigmoidal segment. The tube is then fixed to the sigmoid bowel by catgut suture (Fig. 4384) _ after which the upper segment is drawn down to the lower, and the mucosa of the one sutured to the mucosa of the other. The upper segment is then invaginated into the rectal segment, and the line of junction sutured (Fig. 4385).

Mayo Two-stage Combination Method of Excision of the Rectum.—In the first stage an abdominal colostomy is performed by the Lilienthal method (v. p. 23). After complete union the lower bowel is daily irrigated,

from above and from below – and they are caused to act, by oil, on the fifth or sixth day. The second stage of the operation is performed in from seven to twelve days following the first. The rectum and rectosigmoid are removed through the perineosacral route by the Kraske type of operation. The lower end of the distal limb of the sigmoid, which was brought out as part of the loop to form the colostomy, is closed – and this short piece of sigmoid now closed below, and open alongside of the permanent colostomy opening, is left *in situ*, and from which mucus may drain.



Fig. 4385.—The Same – I; – The completed colorectostomy.

Excision of the Rectum by the Combined Abdominosacral Routes.—After having performed the abdominal part of the operation, and excised the involved segment through a sacroperineal exposure, of the Kraske, or Rehn-Rydygier type, the resulting distal end of the sigmoid may not reach to the anal orifice (if that and the sphincters be left) – or may not reach low enough for even a colorectorrhaphy, with the anorectal canal (if they be present) – so that the only remaining alternative is to form a parasacral anus – as described on p. 272.

Weir's Modification of Maunsell's Abdomino-anal Proctectomy.—Maunsell, through a median abdominal section, mobilized the involved bowel, ligated the intestine well below the growth, and then divided it still lower. He

conducted the ligature through the distal bowel segment and out through the anus, and then invaginated the growth and the proximal segment through the distal segment, at the same time inverting the distal segment upon itself. Where the growth was large, he incised the anus posteriorly, as far as necessary, to accomplish the invagination and inversion. Weir, finding difficulty in delivering the bowel and tumor, even through the incised anus, devised the following modification: – Opening the abdomen with the patient in the Trendelenburg position, he tied the inferior mesenteric artery as it crosses the sacral promontory, and, incising the peritoneum, mobilized the sigmoid and rectum, to the end of the coccyx and lower part of the prostate. He then tied two iodoform tapes, 2.5 cm. (1 inch) apart, about the sigmoid below the growth (Fig. 4386), and then divided the bowel between them. The involved portion of

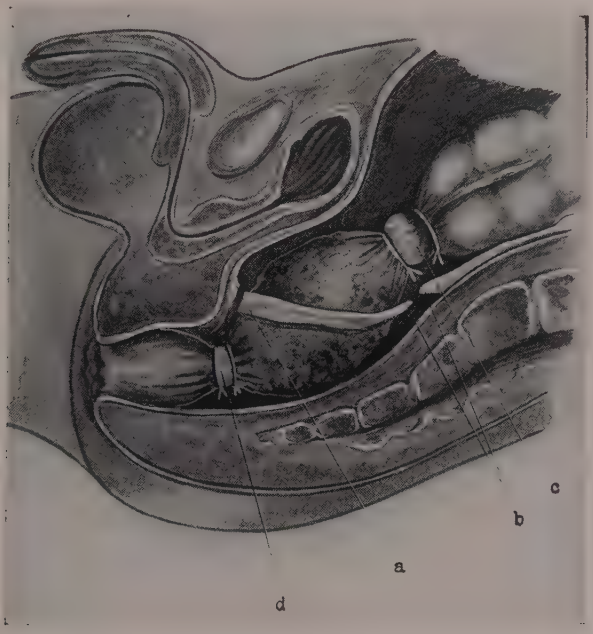


Fig. 4386.—Weir's Modification of Maunsell's Abdomino-anal Proctectomy – I; – The sigmoid and rectum are shown freed by blunt dissection – the posterior rectal reflection of peritoneum and the vesicorectal reflection being divided at a and b. The rectum is doubly ligated above and below the growth, c and d – after which the lower end is divided between ligaments and delivered through the abdomen, and the free portion of the rectum then further divided between the upper ligaments. (Redrawn from Tuttle.)

the bowel, drawn out of the wound, is severed below the growth, and removed through the abdominal opening. The upper end of the anal bowel segment is seized with forceps and inverted upon itself, down and out through the anus. A pair of long forceps is then carried, from below, through this inverted and everted segment and upward into the pelvis, where the lower end of the upper segment (from which the growth and adjacent part of the bowel has been removed) is caught and drawn down through the inverted segment, and out through the anus, where the two ends are held by a penetrating pin, until sutured together marginally (Fig. 4387). The pin is then withdrawn, and the invagination reduced, leaving one continuous axial length of bowel (Fig. 4388). The abdominal cavity is then shut off from the pelvic space by suturing the

peritoneum together and to the bowel. The abdomen is closed. A tubal drain is placed in the lower pelvic space by a median incision between anus and coccyx. Finally, a rectal tube is anchored in the anorectum.

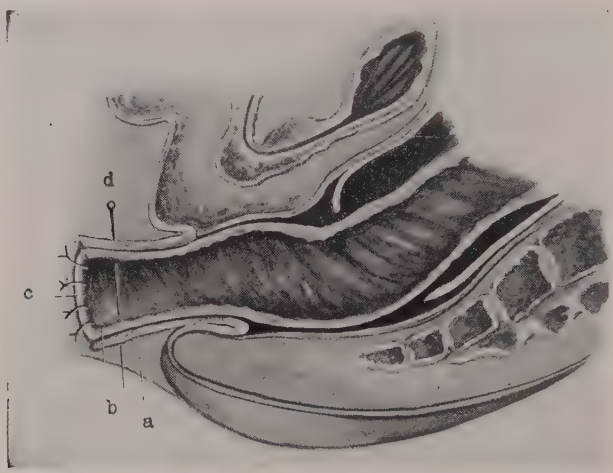


Fig. 4387.—The Same—II: —a, Rectum inverted through the anus; —b, sigmoid brought down through the rectum; —c, circular suturing of the margins of the rectum and sigmoid; —d, penetrating needle holding segments in relation during suturing.

Kelly's Colorectostomy Following Excision of the Rectosigmoid.—Kelly excised the upper part of the rectum and a portion of the pelvic colon, and

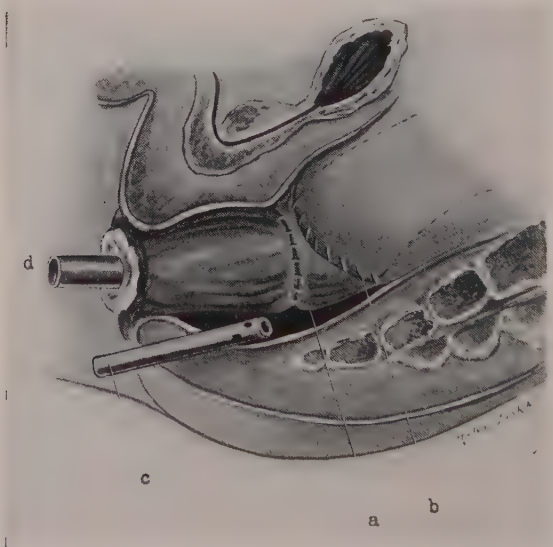


Fig. 4388.—The Same—III: —a, Rectosigmoid suture; —b, abdominal peritoneum sutured; —c, drainage tube in postrectal connective tissue; —d, tube and gauze in rectum.

then invaginated the proximal end of the colon into an axial opening made in the anterior rectal wall, in Douglas' *culdesac*—after closing the upper end of the

rectal segment by invagination. In this way peritoneal surfaces of both colon and rectum were brought into contact for union after the stitches which tem-

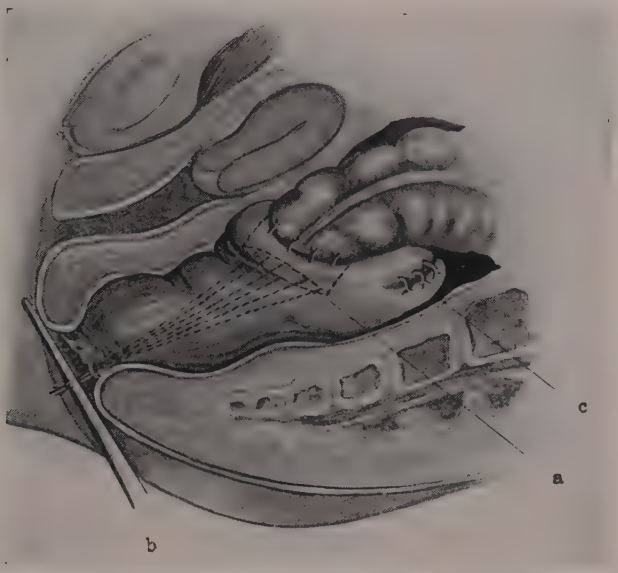


Fig. 4389.—Kelly's Colorectostomy Following Excision of the Rectosigmoid _ I: _ a, Invagination of the divided colon through an incision in the anterior wall of the rectum, guided by sutures passing out through the rectum; _ b, tractor of colon sutures; _ c, closed end of excised sigmoid.



Fig. 4390.—The Same _ II; _ Destroying an obstructing spur, subsequent to operation, by means of forceps pressure. (The sutures closing the rectum represent a previous stage of the operation, considerably antedating removal of the spur.)

porarily held the colon in the rectal opening had ceased to functionate (Fig 4389). Finally, the spur, which was to be expected from this technic, was removed by clamp pressure applied from the anus (Fig. 4390).

CHAPTER LXXIV

OPERATIONS UPON THE KIDNEYS AND SUPRARENAL BODIES

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SURGICAL ANATOMY OF THE SUPRARENAL GLANDS

Description.—The suprarenal glands, or bodies, are two small, flattened structures somewhat capsular in form (suprarenal capsules), lying in the epigastric region, to the lateral aspects of the spine, each in close relationship with the upper pole of the corresponding kidney. They belong to the group of ductless glands _ and are considered among the urinary organs only because of their intimate anatomic relations with the kidneys.

Structure.—They consist of the following parts: _ (*a*) Thin connective-tissue sheath which sends down supporting processes, or trabeculæ, into the cortical and medullary parts, constituting the framework of the organs, _ (*b*) Cortical Substance, consisting of zones of cells of different types, which, from without, inward, are, the zona glomerulosa, zona fasciculata, and zona reticularis, _ (*c*) Medullary Substance, formed by cells of varying shape, filling the fibrous stroma. The arteries of the suprarenal bodies are three comparatively large vessels, from the aorta, phrenic and renal. They enter the cortex of the glands and form capillaries around the cell groups _ and from the medullary venous plexus the suprarenal vein emerges through the hilum of the gland, emptying, on the right, in the postcava, and, on the left, in the renal vein. The lymphatics, beginning around the commencement of the

suprarenal vein, empty into the aortic lymphatic glands of the corresponding side. The nerves are very numerous, and come from the solar and renal plexuses and, as stated by Bergmann, from the phrenic and vagus.

Relations of the Right Suprarenal Gland.—Somewhat triangular in shape, it rests upon the antero-internal aspect of the upper pole of the right kidney, between the posterior aspect of the right lobe of the liver and the part of the diaphragm covering the side of the spine; – Anteriorly – the inferior vena cava, liver, peritoneum, and the hilum of the gland; – Posteriorly – the diaphragm and kidney.

Relations of the Left Suprarenal Gland.—Somewhat semilunar in shape, and generally somewhat the larger, it rests upon the inner border of the upper pole of the left kidney; – Anteriorly – the posterior aspect of the stomach, peritoneum, pancreas, splenic vessels, and the hilum of the gland; – Posteriorly – the left crus of the diaphragm and the kidney.

OPERATIONS UPON THE SUPRARENAL BODIES

The most frequent conditions of the suprarenal bodies, calling for surgical interference, are – tumors – tuberculosis (Addison's disease) – and, sometimes hematomata and injuries. When suppuration occurs, it is usually due to tuberculosis.

The innocent tumors usually encountered are – adenoma (an overgrowth of fatty glandular tissue – the commonest benign tumor) – fibroma – lipoma – angioma – and lymphangioma.

The malignant tumors are – carcinoma – and melanotic and non-pigmented sarcomata (the latter sometimes becoming enormous).

More than 80 per cent. of the pathology of the suprarenal bodies is tubercular in origin.

The operation most frequently called for in connection with the suprarenals is excision – and the procedure has been most frequently applied for the relief of Addison's disease and for tumor.

The removal of a single suprarenal body in man, especially if it be diseased, may be considered a safe procedure. The removal of both suprarenals in the lower animals has been followed by death.

Approach to the suprarenal body has been secured through either the lumbar or abdominal route (by an incision from the xiphoid cartilage to the umbilicus). The indication for its excision has sometimes been discovered through an abdominal operation – occasionally, as an incident – and the removal of the body then accomplished through the loin. Both routes are sometimes employed simultaneously.

The best method of approach is secured by an especially free lumbar incision – planned as for an extended kidney operation by the lumbar incision.

In benign and in tubercular cases Jonas stresses the avoidance of removing the semilunar ganglion.

OPERATIONS UPON THE MALE AND FEMALE GENITO-URINARY ORGANS, IN GENERAL

No hard-and-fast line can, of course, be drawn between male organs which are engaged, on the one hand, solely in urinary functions – and, on the other, solely in sexual functions – the penis functionating primarily as a sexual organ and secondarily as a urinating organ (in that it conveys the urethra).

In the female, however, the organs which are concerned in urination take no part in sexual life.

In the present work the following convenient, but somewhat arbitrary arrangement of the genito-urinary organs, of male and female, will be adopted,

in consideration of the structures and the operative surgery applied to them, – namely – Those which are, first, common to both male and female; and which, second, are concerned solely in the elimination, conduction, and storage of urine, will be considered as Urinary Organs of Both Sexes, – and all of the rest, as Male Sexual Organs or as Female Sexual Organs.

The operations which are performed upon the Pregnant and Puerperal Uterus, and in Extra-uterine Pregnancy will be separately considered.

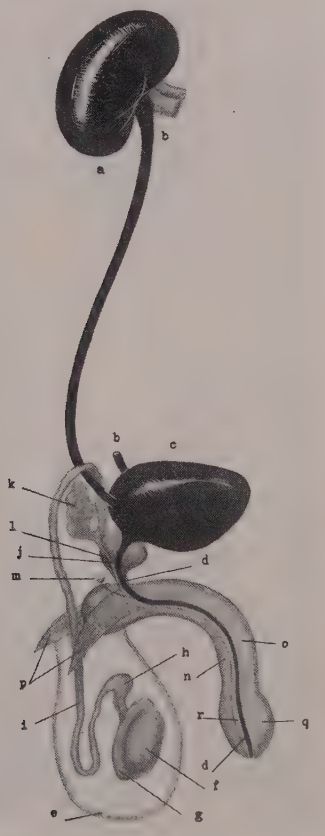


Fig. 4391.—Scheme of the Male Urinary and Genital Organs: (A) The Male Urinary Organs (in black): – a, Kidney; – b, ureter; – c, bladder; – d, d, prostatic membranous, perineal and peneal urethra (its urine-transmitting function represented in black). (B) The Male Genital Organs (in gray): – e, Scrotum; – f, testicle; – g, epididymis; – h, globus major; – i, vas deferens; – k, vesicula seminalis; – j, ejaculatory duct; – l, prostate gland; – m, bulbo-urethral (Cowper's) gland, – n, corpus spongiosum; – o, corpus cavernosum; – p, p, crura penis; – q, glans penis; – r, urethra penis (its semen-transmitting function represented in gray). (Modified from Sobotta and McMurrich.)

Where a lesion involves two or more structures, as, for instance, vesico-vaginal fistula, or vesico-uterovaginal, it will usually be found, according to circumstances, either under that organ which it chiefly involves, or under that organ in connection with which its presence is of greater or greatest consideration – or, again, it might be given under that organ through which, or in conjunction with which, the operative repair of the lesion is best made.

The divisions of these subjects, in the present writings, will be given as

classified, and in the order mentioned, in the following graphic groupings _ and as pictorially illustrated in Figs. 4391 and 4392.

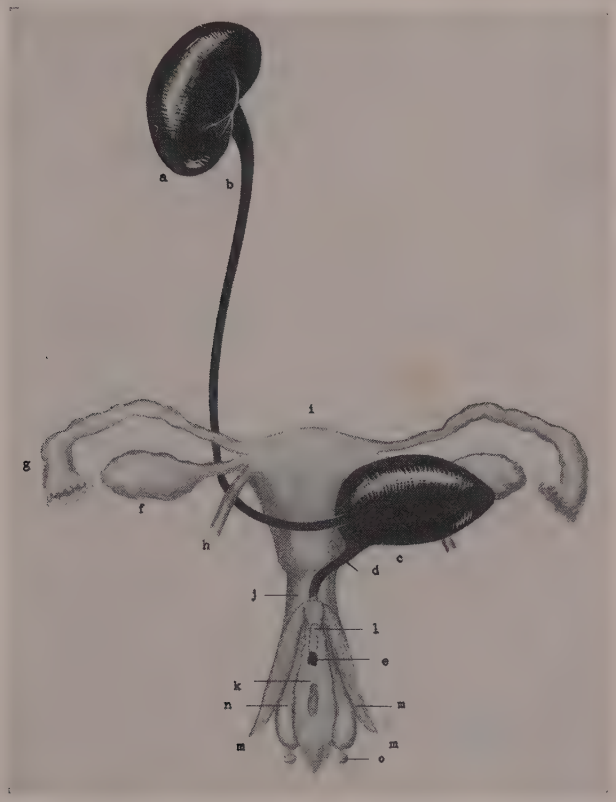


Fig. 4392.—Scheme of the Female Urinary and Genital Organs: _ (A) The Female Urinary Organs (in black): _ a, Kidney; _ b, ureter; _ c, bladder (displaced); _ d, urethra; _ e, meatus urinarius. (B) The Female Genital Organs (in gray): _ f, Ovary; _ g, fallopian tube; _ h, round ligament; _ i, uterus; _ j, vagina; _ k, vaginal vestibule; _ l, clitoris; _ m, m, crura clitoridis; _ n, bulbus vestibuli; _ o, glans vestibuli and duct. (Modified from Sobotta and McMurrich.)

(*a*) **Operations Upon the Male and Female Urinary Organs:** _

Kidneys _ male and female.
Ureters _ male and female.
Bladder _ male and female.
Urethra _ male and female.

(*b*) **Operations Upon the Male Genital Organs:** _

Prostate gland.
Cowper's glands.
Penis.
Scrotum.
Testicles.
Spermatic cord.
Epididymis.
Vas deferens.
Seminal vesicles.
Ejaculatory ducts.

(*c*) **Operations Upon the Female Genital Organs:**—

Mons veneris.
Labia majora.
Labia minora.
Vaginal vestibule.
Clitoris.
Bulbus vestibuli—vaginal bulb.
Vestibular glands of Bartholin.
Skene's glands.
Vagina.
Uterus.
Round ligaments.
Fallopian tubes.
Ovaries.
Ovarian ligaments.

(*d*) **Operations Upon the Pregnant and Puerperal Uterus and Operations for Extra-uterine Pregnancy:**

The Suprarenal Glands, which are ductless glands, and not connected with either the urinary or with the sexual functions, will be considered, from their surgical standpoint, before beginning with the Kidneys—as the Suprarenal Bodies are, anatomically, in such close relationship with the kidneys as to make their consideration in this connection convenient—the basis of classification of these writings being largely anatomic.

SURGICAL ANATOMY OF THE KIDNEYS

Description.—Each kidney lies partly in the hypochondriac, lumbar, epigastric, and umbilical regions—abutting upon the confines of each—resting upon the lower part of the diaphragm and areolar fatty tissue covering the quadratus lumborum and psoas magnus—and placed behind the peritoneum. They lie embedded in abundant fatty areolar tissue, more abundant posteriorly than anteriorly—constituting the fatty areolar capsule. The right kidney generally (though not always) lies about 7 mm. to 1.3 cm. ($\frac{1}{3}$ to $\frac{1}{2}$ inch) lower than the left (owing to the presence of the liver upon the right). Vertically, the kidneys correspond to the space between the upper border of the twelfth dorsal and the first and second (and sometimes the upper half of the third) lumbar vertebræ—and to the eleventh and twelfth ribs and transverse processes of the first and second lumbar vertebræ—the left kidney generally reaching to the upper border of the eleventh rib—and the right kidney generally reaching to the lower border of the eleventh rib. Outer borders of the kidneys lie from 9 to 10 cm. ($3\frac{1}{2}$–4 inches) external to the lumbar spines. The superior poles of the kidneys lie about 5 cm. (2 inches), and the inferior poles from 6.3 to 7.6 cm. ($2\frac{1}{2}$–3 inches), from the median line. Inner border of right kidney lies close to the vena cava—the inner border of the left kidney lies within 2.5 cm. or more (1 inch or more) of the aorta. The kidneys average 10 to 12 cm. (4–$4\frac{3}{4}$ inches) in length—2.8 cm. ($1\frac{1}{8}$ inches) in thickness—6.3 cm. ($2\frac{1}{2}$ inches) in breadth—and weigh about $4\frac{1}{2}$ ounces. There may be an irregularity from the normal in the form, size, number, position, and mobility of the kidneys.

Peritoneal Relations of the Kidneys:

Posterior surfaces of both kidneys are uncovered by peritoneum. Upon the anterior surface of the right kidney—the hepatic and mesocolic areas are peritoneal—and the areas of the duodenum and transverse colon are non-peritoneal. Upon the anterior surface of the left kidney—the gastric area

is peritoneal _ the pancreatic area is non-peritoneal _ the outer part of the colic area is non-peritoneal, and the inner part of the colic area is peritoneal.

Fixations.—(1) Fatty areolar tissue or capsule _ in which the kidneys are embedded _ derived from parietal subperitoneal fascia _ and separates them from the diaphragm and from the anterior lamella of the lumbar fascia covering the quadratus lumborum and psoas muscles. (2) Vessels, nerves, and connective tissue form the pedicle. (3) Partial covering of peritoneum upon their anterior surfaces and borders.

Relations.—Anterior Surface—(*a*) Right Kidney: _ Liver (right lobe) _ peritoneum intervening; ascending colon and hepatic flexure; duodenum (descending part); suprarenal capsule (to slight extent). (*b*) Left Kidney: _

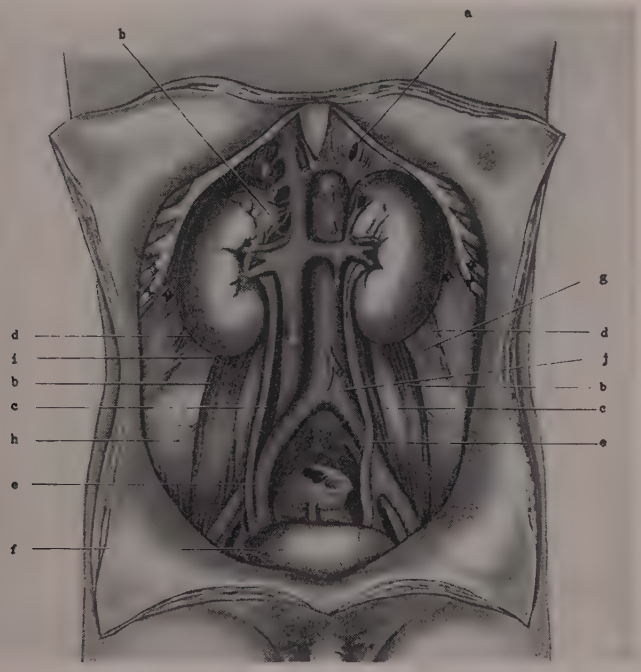


Fig. 4393.—Anterior Aspect of the Topography of the Kidneys and Ureters from Within the Abdomen: _ a, Esophageal opening in the diaphragm; _ b, suprarenal body; _ d, d, kidneys; _ i, abdominal aorta and inferior vena cava; _ b, b, psoas major muscles; _ c, c, psoas minor muscles; _ g and h, ventral branches of lower thoracic and upper lumbar nerves; _ e, e, ureters, _ f, bladder; _ j, bifurcation of the aorta. (Redrawn from various anatomies.)

Stomach (fundus) _ peritoneum of lesser sac intervening; pancreas (tail); splenic artery and vein; splenic flexure of colon and upper part of descending colon; duodenum (ascending part); suprarenal capsule (to slight extent).

Posterior Surface—both Kidneys: _ Areolar fatty tissue, separating the kidneys from diaphragm and quadratus lumborum and psoas muscles; posterior abdominal wall, corresponding to eleventh and twelfth ribs and transverse processes of first and second lumbar vertebræ; diaphragm (areolar tissue intervening); anterior layer of posterior aponeurosis of transversalis (*i. e.*, anterior layer of lumbar fascia), separating kidney from quadratus lumborum; psoas; diaphragmatic, transversalis and iliac fascia lining diaphragm, transversalis, and iliacus; twelfth dorsal, iliohypogastric and ilio-

inguinal nerves; anterior divisions of first and second lumbar arteries and veins. The nerves and vessels just mentioned all pass downward and outward anteriorly to the quadratus lumborum and pierce the transversalis beyond the external border of the quadratus. *Note:* The left kidney is in contact with a larger area of diaphragm than the right – and the amount of diaphragm in contact may be increased on both sides when the arcuate ligaments are attached to the tips of the transverse processes of the second lumbar vertebra. **External border:** – (*a*) Right Kidney; liver (upper two-thirds)

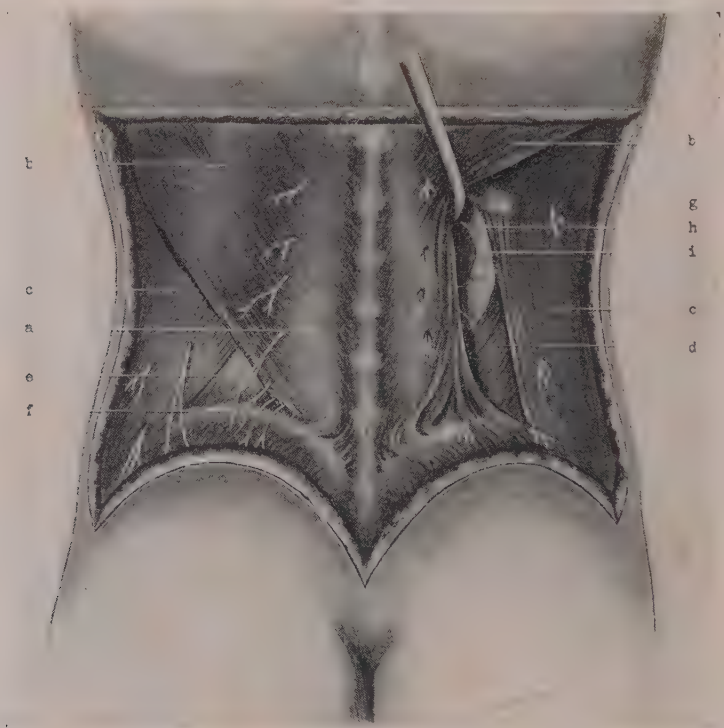


Fig. 4394.—Superficial Anatomy of the Back in the Kidney Region: – a and b, Left latissimus dorsi muscle; – b, right latissimus dorsi, retracted inward and upward; – c, c, external oblique muscles; – e, Petit's triangle (covered by fascia, and bounded, internally, by latissimus dorsi; externally, by external oblique; inferiorly, by iliac crest); – f, iliac crest; – g, twelfth rib; – h, superior lumbar trigone (bounded, above, by serratus posticus inferior; below, by internal oblique; externally, by tip of twelfth rib and external oblique; internally, by sacrospinalis – the floor of the inner part of the trigone corresponding with the outer border of the quadratus lumborum). Cutaneous branches of the twelfth thoracic and of the lumbar nerves are shown – and the twelfth thoracic and first lumbar nerves, with a lumbar artery, in the superior trigone. (Redrawn from various anatomies, and from Kelly and Burnham.)

ascending colon (lower third). (*b*) Left Kidney; spleen (above); descending colon (below). **Internal border:** – (*a*) Right Kidney; near vena cava; structures of hilum (*q. v.*). (*b*) Left Kidney; 2.5 cm. or more (1 inch or more) from aorta; structures of hilum (*q. v.*). **Superior extremity** (both Kidneys): Suprarenal capsule – which encroaches also upon the anterior and internal border and is bound to the kidney by the connective tissue of the subperitoneal fascia. **Inferiorly** (both Kidneys) – come within about 5 cm. (2 inches) of the crest of the ilium.

Relations of the Pleuræ.—The pleuræ are in proximity to, but not in

relation with, the kidneys. The lower limit of the pleura extends nearly horizontally outward from the lower margin of the twelfth dorsal vertebra – crossing the twelfth rib close to its neck – and crossing the eleventh rib about 5 cm. (2 inches) beyond (external to) its neck.

Relation of Structures Within the Sinus of the Kidney.—(*A*) Structures; – Branches forming renal artery; branches forming renal vein; lymphatic vessels and glands; plexus of nerves; ureter; areolar fatty tissue. (*B*) Order of Structures from Before Backward: – (*a*) Right Kidney – vein, artery, ureter: – (*b*) Left Kidney – vein, artery, ureter. (*C*) Order of Structures

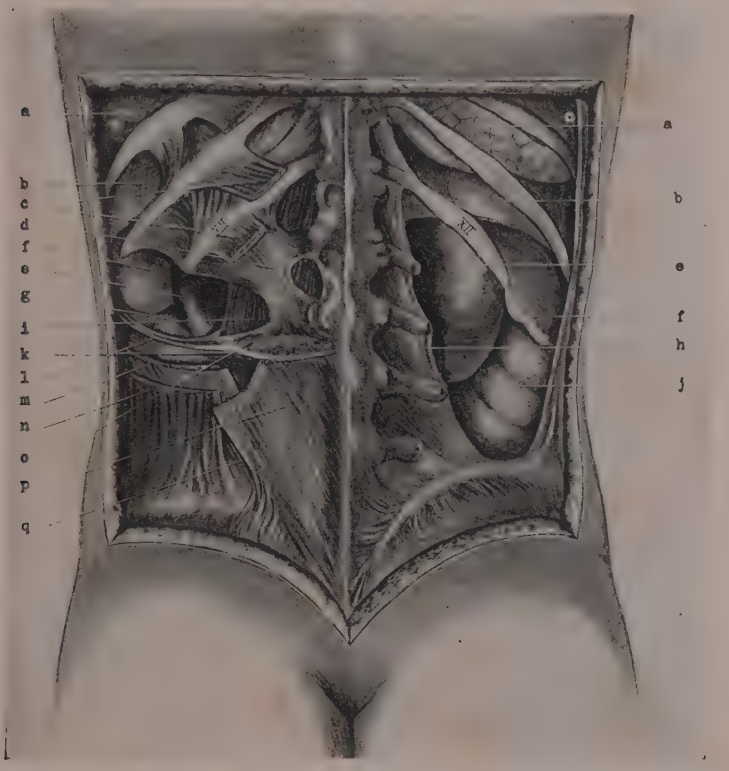


Fig. 4395.—Anatomy of the Back in the Kidney Region – Intermediate, upon the left – and deeper, upon the right: – a, a, Lungs; – b, b, diaphragm; – c, serratus posticus inferior; – d, lumbocostal ligament; – p, latissimus dorsi; – n, external oblique; – m, internal oblique; – l, transversalis; – q, Petit's triangle; – o, sacrospinalis in transverse section; – h, intertransversales laterales; – i, quadratus lumborum, – k, lumbar trigone; – f, spleen; – g, splenic flexure of colon; – f, (right) liver; – j, descending colon; – e, e, kidneys. (Redrawn from various anatomies and from Kelly and Burnham.)

from Above Downward: – (*a*) Right Kidney – vein, artery, ureter; – (*b*) Left Kidney – artery, vein, ureter.

Arteries.—Renal, suprarenal, spermatic, and lumbar – all from aorta.

Veins.—Renal. Right vein empties directly into vena cava. Left vein receives left spermatic (or left ovarian), left inferior phrenic, and sometimes left suprarenal before emptying into vena cava.

Nerves.—From solar and aortic plexuses, semilunar ganglia, splanchnics and pneumogastrics.

Lymphatics.—Superior and deep sets – emptying into lumbar glands.

Description of Lumbar Fascia.—Consists of three layers, which ensheathe erector spinæ and quadratus lumborum muscles. (**1**) **Posterior or superficial layer:**—Layer through which latissimus dorsi, and serratus posticus inferior beneath it, are connected to the vertebral spines (same thing as aponeurosis of those muscles). Latissimus dorsi is connected with it most posteriorly—serratus posticus inferior, lying beneath latissimus dorsi, is connected with its upper part anteriorly to latissimus dorsi—and beyond the line along which these two muscles are connected with it (*i. e.*, after these two muscles are free of it) it gives origin to the posterior part of the internal oblique—and then passes on (after internal oblique is free of it) to merge with middle layer—thus binding down posterior aspect of erector spinæ. It is continuous with the vertebral aponeurosis. (**2**) **Middle layer:**—Arises from

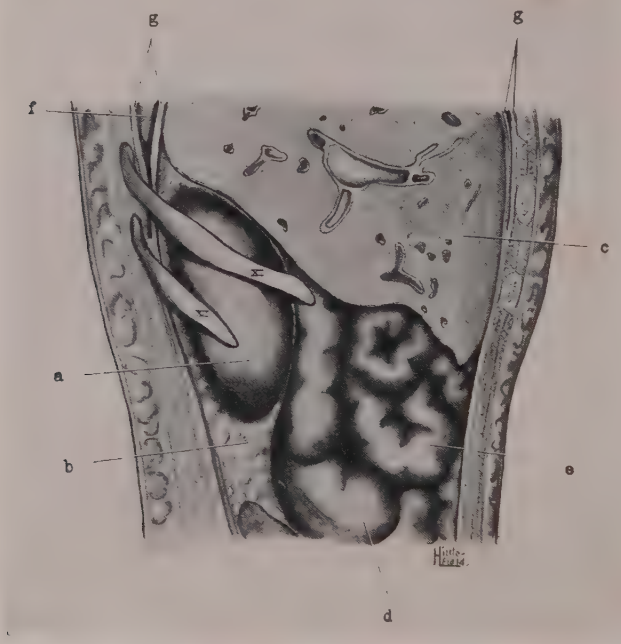


Fig. 4396.—Lateral View of the Right Kidney:—**a**, Kidney, overlapped by eleventh and twelfth ribs;—**b**, bed of fatty, areolar tissue;—**c**, liver;—**f**, lung;—**g, g**, pleural reflections. (Redrawn from various anatomies.)

tips of lumbar transverse processes—runs outward between quadratus lumborum in front and erector spinæ behind, to fleshy part of transversalis muscle—forming posterior aponeurosis of transversalis. It is joined at outer border of erector spinæ by posterior layer—and at outer border of quadratus lumborum by anterior layer. It is attached, above, to lower margin of last rib—and, below, to iliolumbar ligament and adjacent iliac crest. (**3**) **Anterior layer:**—attached to front of lumbar transverse processes at inner border of quadratus lumborum—covering anterior surface of quadratus lumborum to its outer border, where it becomes united with middle layer and becomes the transversalis fascia. Attached above (forming ligamentum arcuatum externum) to front of transverse processes of first (or second) lumbar vertebra and apex of last rib, and, below, to iliolumbar ligament and iliac crest (Figs. 4394 and 4395).



Fig. 4397.—Transverse Section of the Kidney Region Above the Level of the Transverse Colon: – a, a, Peritoneal cavity; – e, e, kidneys; – g, aorta and one of renal arteries; – h, vena cava and one of renal veins; – d, liver; – f, spleen; – c, pancreas; – b, stomach; – k, external oblique; – j, internal oblique; – i, transversalis; – l, latissimus dorsi; – o, sacrospinalis; – m, quadratus lumborum; – n, psoas major; – p, psoas minor; – s, the three lowermost ribs, designated by Roman numerals; – r, spinal cord; – q, spinous process; – The peritoneum is shown in dotted line. (Redrawn from various anatomies.)

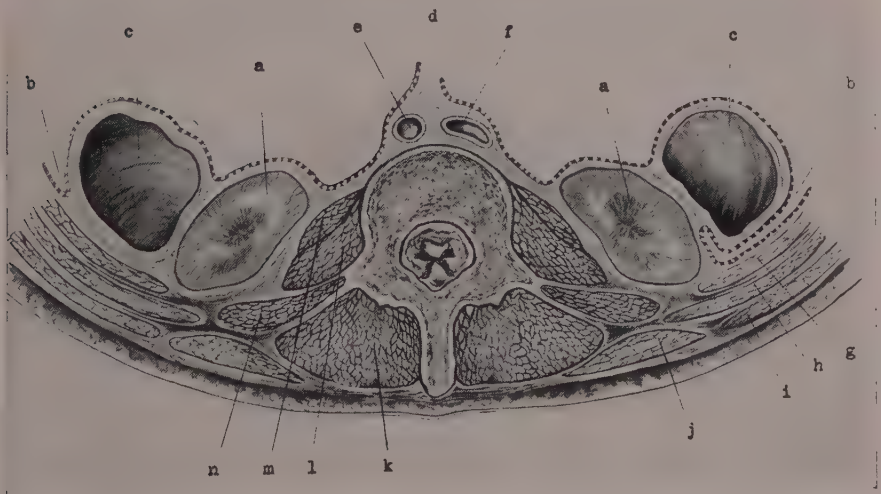


Fig. 4398.—Transverse Section of the Kidney Region Below the Level of the Transverse Colon: – b, b, Peritoneal cavity; – c, (left), descending colon; – c (right), ascending colon; – a, a, kidneys; – e, abdominal aorta; – d, prevertebral space; – f, inferior vena cava; – n, quadratus lumborum; – m, psoas minor; – l, psoas major; – k, sacrospinalis; – j, latissimus dorsi; – i, external oblique; – h, internal oblique; – g, transversalis. The peritoneum represented in dotted line. (Redrawn from various anatomies.)

SURFACE FORM AND LANDMARKS OF THE KIDNEYS

A horizontal line through the umbilicus will be below the lower border of each kidney – about 2.5 cm. (1 inch) below the right kidney and 4 cm. ($1\frac{1}{2}$ inches) below the left (Quain). According to Treves, such a line will intersect the lower portion of the right kidney and pass below the left.

A vertical line from the middle of Poupart's ligament upward to the costal arch will have one-third of the kidney to its outer, and two-thirds of the kidney to its inner side.

Posteriorly, the kidney lies within a parallelogram included within the four following lines: (*a*) Line parallel with and 2.5 cm. (1 inch) external to the spine, from the lower border of the tip of the eleventh dorsal spine to the center of the tip of the third lumbar spine, – (*b*) Line drawn outward for 7 cm. ($2\frac{3}{4}$ inches) at a right angle to, and from the upper end of line **a**, – (*c*) Line drawn outward for 7 cm. ($2\frac{3}{4}$ inches) at a right angle to, and from the lower end of line **a**, – (*d*) Line parallel with line **a**, between the outer ends of lines **b** and **c**.

The right kidney is generally from 1.3 to 2 cm. ($\frac{1}{2}$–$\frac{3}{4}$ inch) lower than the left – and will lie that far below the measurements given above.

The upper border of the kidney lies upon a level with the eleventh intercostal space and with the eleventh or twelfth dorsal spine – the right kidney lying somewhat lower.

The twelfth ribs divide the kidneys, approximately, into a superior and an inferior half.

The lower border of the kidney about corresponds with the center of the spinous process of the third lumbar vertebra.

The kidneys are accessible to pressure in the triangle formed by the lower border of the twelfth rib above, and the outer border of the erector spinæ internally.

The axes of the kidneys are oblique – from above and within, downward and outward.

The superior pole of the kidney is about 5 cm. (2 inches) from the median plane.

The hilum of the kidney lies about 5 cm. (2 inches) from the interval between them.

The inferior pole of the kidney lies about 6.3 to 7.5 cm. ($2\frac{1}{2}$–3 inches) from the middle line.

The inner border of the upper part of the kidney lies about 2.5 cm. (1 inch) external to the middle line of the body. The inner border lies upon the external border of the psoas – the rest of the kidney lying upon the lumbar fascia covering the quadratus lumborum.

The outer border of the lower part of the kidneys is about 9.5 cm. ($3\frac{3}{4}$ inches) from the middle line. The external border lies from 2 to 3 cm. ($\frac{3}{4}$–$1\frac{1}{4}$ inches) to the outer side of the external border of the quadratus lumborum muscle.

The ureter expands into the pelvis of the kidney opposite the lowerr half of the kidney.

Both kidneys rest upon the lower portion of the arch of the diaphagm (as it comes downward between the kidneys and the twelfth ribs), quadratus lumborum, anterior layer of lumbar fascia, and psoas muscle.

The external border of the erector spinæ is the superficial guide to the kidney – and the quadratus lumborum the deep guide – the former muscle marking the twelfth rib about 6.3 cm. ($2\frac{1}{2}$ inches) from the median line – and the latter being attached to the inner half of the twelfth rib (Fig. 4395).

GENERAL SURGICAL CONSIDERATIONS IN OPERATING UPON THE KIDNEYS

In preparation for operations upon the kidneys the patient's general condition should be gotten into as satisfactory a state as the circumstances of the case will permit. And, at the time of operation, the patient should come to the table with bowels and bladder empty, and with the site of incision shaved and preliminarily prepared, and protected by a sterile dressing.

The kidney functions generally and their competency in particular should be definitely ascertained in advance of subjecting the patient to operation — unless the imperativeness of the condition admits of no delay or choice.

In all cases where a kidney is to be removed, it is absolutely necessary to ascertain, in advance of the actual removal of the involved kidney, whether the opposite kidney is present and functioning. If this cannot be predetermined by ureteral catheterization (preferably of both kidneys, and certainly

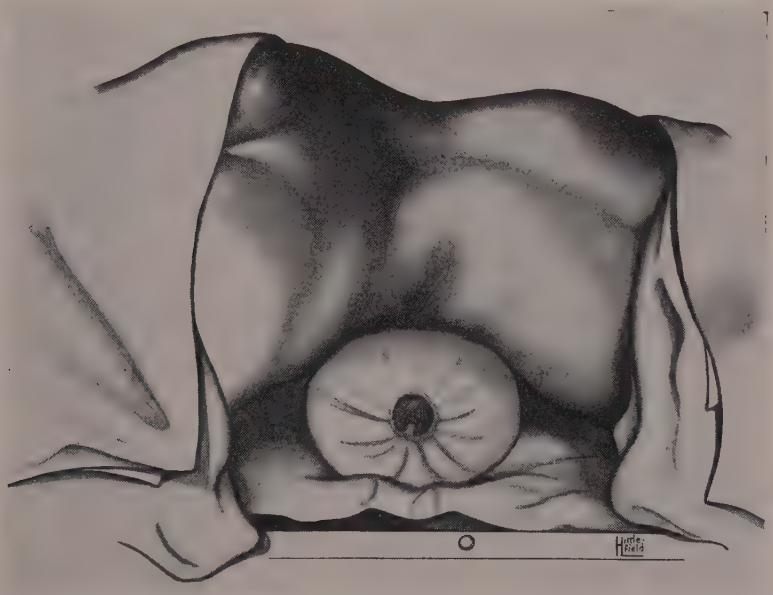


Fig. 4399.—Position of the Patient in the Lateral Posture, with the Lumbar Region Resting Upon a Support, Thus Rounding Out the Opposite Lumbar Region.

of the only one to be left), then, at the time of the operation, the opposite kidney should be investigated by the surgeon's hand. This is readily carried out in exposure of the field by the intra-abdominal route — and, in extra-abdominal operations the peritoneum should be incised at the side of the kidney being operated upon, and, through this opening, the surgeon's hand introduced sufficiently for the examination of the opposite kidney.

In operating extraperitoneally the patient lies upon the sound side, near the edge of the table, with a firm cushion or support under the opposite loin, to round out and make prominent the side of the operation and increase the interval between the twelfth rib and the iliac crest. The surgeon stands at the patient's back, cutting from above downward on the right side, and in the reverse, or in the same direction, on the left. The assistant stands opposite. In operating transperitoneally the position is the same as for median abdominal section.

Approach to the kidney may be by the extraperitoneal or transperitoneal route _ preferably the former.

An incision to expose the kidney may go, with safety, to the lower border of the twelfth rib. If the eleventh be the last rib, the pleura would be endangered

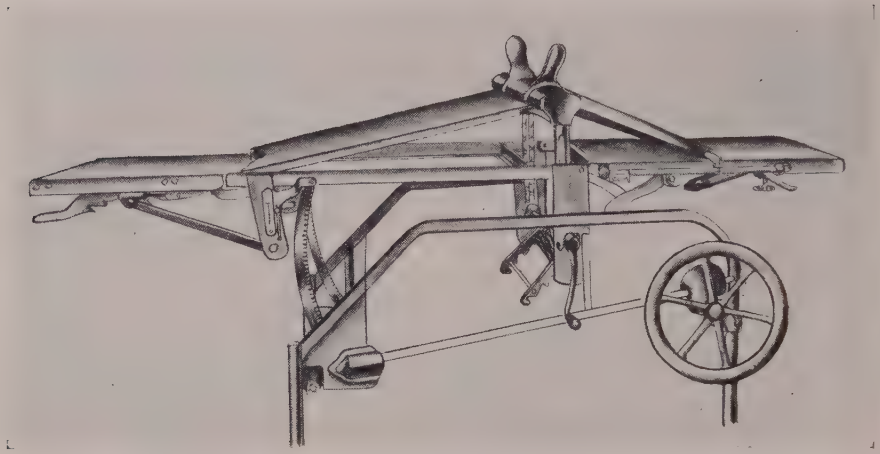


Fig. 4400.—Upper Part of the Hartley-Murray Operating-table _ showing the adjustable device for rendering the lumbar region prominent in the oblique lateral position for kidney operations. The abdominal and dorsal saddle-pommel devices steady the patient.

if that rib were taken for the twelfth. If the thirteenth rib be present, the operation area would be contracted.

Do not take for granted that the last rib is the twelfth rib _ else the pleura may be wounded. Always count the ribs from above.

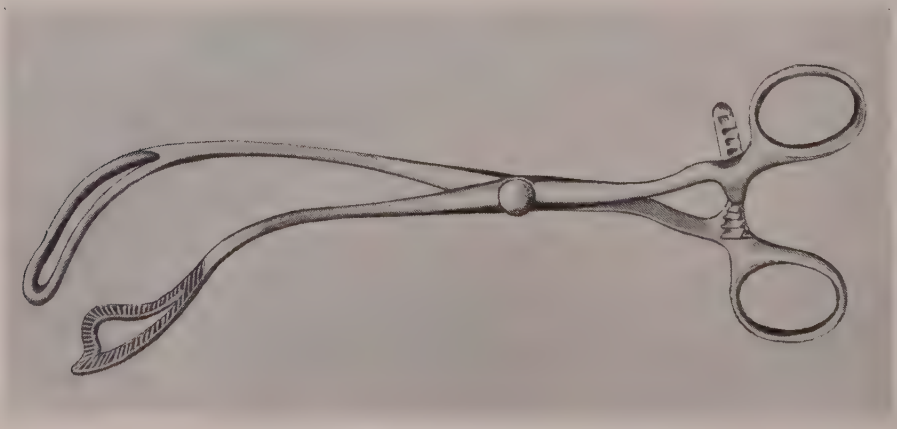


Fig. 4401.—Sherk's Uterine-elevating Forceps.

The pleuræ may reach lower where the arcuate ligaments are attached to the second lumbar vertebra.

If necessary to better expose the kidney, the twelfth rib may be excised subperiosteally, in whole or in part.

Hemorrhage in kidney operation is often great. It may be controlled: _ by

compression of the pedicle by the fingers, or a special forceps temporarily applied _ by gauze pressure of the bleeding surface _ by hot douching. Suturing of bleeding surfaces in contact also controls hemorrhage. In bisection of the healthy kidney pressure of the pedicle is necessary. Diseased kidney bleeds less than healthy kidney substance.

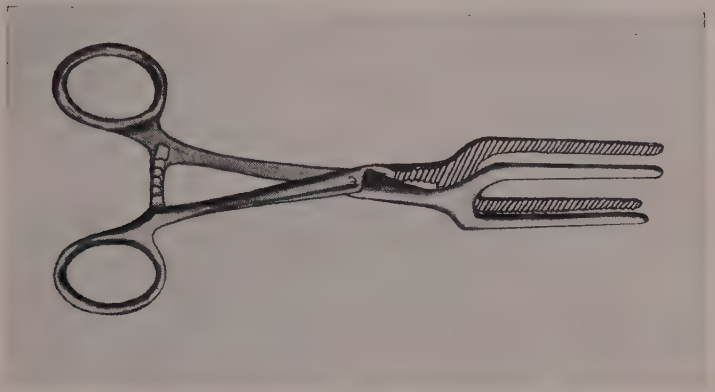


Fig. 4402.—Désjardin's Intestinal or Kidney Forceps.

The right renal vein is generally much shorter than the left _ a fact to be remembered in handling the pedicle of the right kidney.

Gut is preferable to silk throughout in kidney surgery _ as being absorable _ and less apt to form the nuclei of calculi.

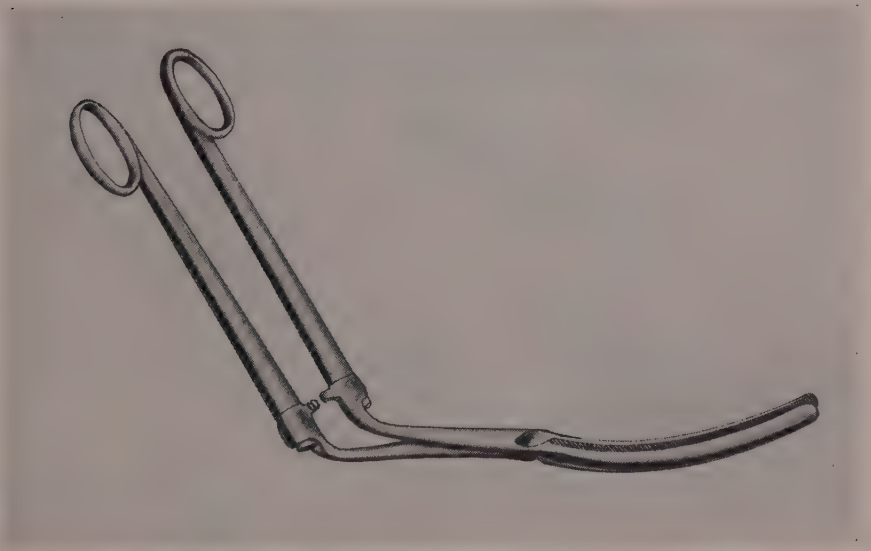


Fig. 4403.—Detachable Handle Kidney Pedicle Clamp. (From Albarran)

The exposure of the kidney is not an operation in itself _ but is, necessarily, the preliminary step to every specific operation upon the kidney. The kidney is approached by either an extraperitoneal route _ and this, as a rule, is pref-

erable where the conditions of the case and the object of the operation can be accomplished thereby _ or by an intraperitoneal route. The technical procedures most frequently employed for the exposure of the kidneys will be given in the following pages. The paraperitoneal exposure is a modification of the extraperitoneal method.

The position of the patient will depend upon the nature of the operation _ and will be described under the specific operations. The position assumed in operating through the lumbar route, the most frequently employed method, is such as to accomplish two objects _ the prominent rounding-out of the lumbar region of the involved side, and the increase of the working space between the last rib and the iliac crest. These objects are best accomplished by placing the patient upon the uninvolved side, upon a firm support (Fig. 4399). Special forms of table are made for the purpose, which while holding him in the desired position, steady him as well (Fig. 4400).

Convenient forms of kidney-grasping forceps are shown in Figs. 4401 to 4403.

It is sometimes indicated to clamp the kidney pedicle to control hemorrhage during operation _ and in Fig. 4403 is shown a type of clamp whose handles may be temporarily removed, after clamping the pedicle, so that they will not encumber the field of operation.

RETROPERITONEAL, INTERMUSCULAR EXPOSURE OF THE KIDNEY BY THE LUMBAR ROUTE

Description.—The kidney is exposed through the superior lumbar trigone, by a lumbar incision, through which the overlying muscles are simply retracted, without division. This method may be regarded as a procedure to be employed in comparatively simple or minor cases, requiring but moderate room, such as simple abscesses, uncomplicated renal calculus, and kidney fixations.

The superior lumbar trigone is bounded, above, by the border of the serratus posticus inferior; _ below, by the border of the internal oblique; _ medially, by the border of the sacrospinalis; _ and, externally, by the end of the twelfth rib, and by the posterior border of the external oblique.

Preparation _ Position.—See General Surgical Considerations.

Landmarks.—Twelfth rib; outer border of the sacrospinalis (erector spinæ); iliac crest. The superior lumbar trigone, or triangle, is the least resistant area within the space bounded by the twelfth rib and the sacrospinalis muscle.

Incision.—With the patient placed upon the sound side, upon a lumbar support which prominently rounds-out the involved lumbar region, increasing the intercosto-iliac space to the limit (v. Fig. 4399), an incision is begun just above the center, approximately, of the twelfth rib (or over its tip, if the rib be short) _ and passes, thence, obliquely downward and forward, toward a point midway between the vertebral spines and the anterior superior iliac spine (Fig. 4404) to end about 2.5 or 3.8 cm. (1 to 1½ inches) above the iliac crest, or, if the parts be thick, the division of the skin and fascia may extend down to, or nearly to the crest (Fig. 4405, B). If it have been conceived, in advance, that it may be necessary to secure additional room, the incision should, correspondingly, be directed more toward the anterior superior iliac spine. The starting-point of the incision is represented by the junction of the twelfth rib and the outer border of the sacrospinalis. The lower end of the incision lies well to the outer side of Petit's triangle.

Operation.—On deepening this incision through the fascia, cutaneous nerves are encountered, and the latissimus dorsi is exposed posteriorly, and the external oblique (leading up to the last rib), anteriorly, and, in the angle between them, the upper part of Petit's triangle (Fig. 4406).



Fig. 4404.—Extraperitoneal Exposure of the Kidney, Requiring Limited Room, by the Lumbar Route. I; Line of incision, beginning over the twelfth rib, and passing downward and forward toward a point midway between the center of the iliac crest and the anterior superior iliac spine from which, if necessary, it may be prolonged parallel with Poupart's ligament, to expose the ureter.

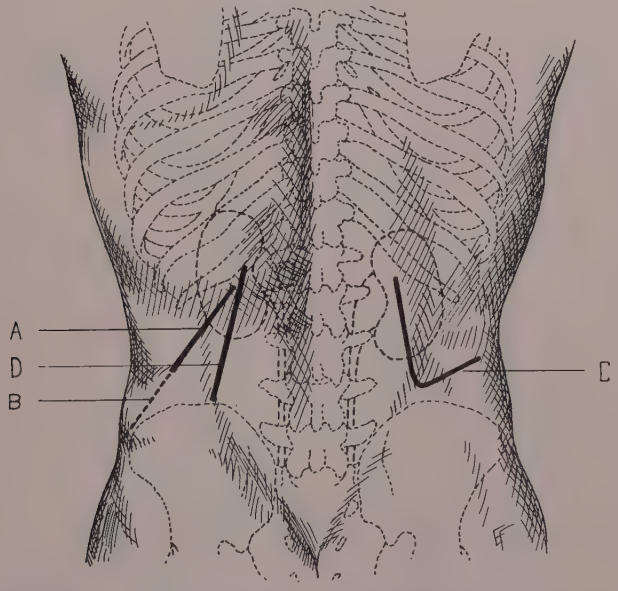


Fig. 4405.—Incision for Exposure of Kidneys by the Lumbar Route: A, Retroperitoneal exposure by oblique lumbar incision; B, continuation of this incision where additional room is required; C, retroperitoneal exposure by Koenig's angular lumbo-abdominal incision; D, incision in Edebohls' operation of nephropexy.

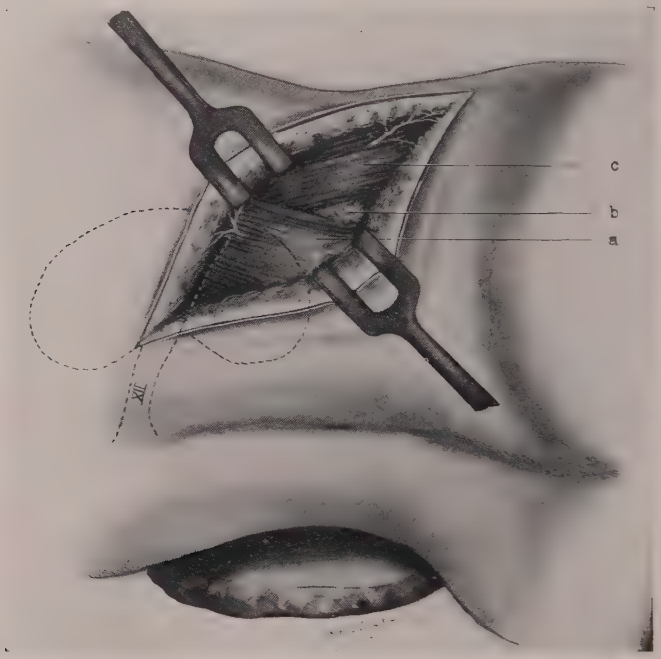


Fig. 4406.—Extraperitoneal Intermuscular Exposure of the Kidney by the Lumbar Route; – The margins of the wound are held apart by retractors, showing, a, the latissimus dorsi; – c, external oblique; – and, b, the upper part of Petit's triangle, occupied by areolar tissue. The kidney contour and the twelfth rib are seen in outline.

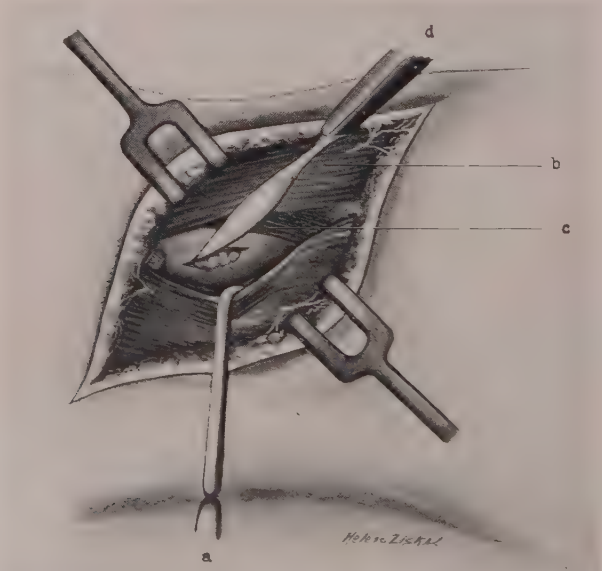


Fig. 4407.—Extraperitoneal Intermuscular Exposure of the Kidney by the Lumbar Route; – a, The outer border of the latissimus dorsi retracted backward; – b, external oblique; – c, internal oblique; – d, knife incising the aponeurosis of the superior lumbar trigone; – XII, twelfth right rib.

The lateral cutaneous branch of the twelfth thoracic nerve, penetrating the external oblique and accompanying vessels are exposed in the incision. By drawing the outer border of the latissimus backward and slightly upward, which may be done, owing to its looseness of connection here, the superior lumbar trigone is exposed (Fig. 4407). (In those cases in which this backward retraction of the latissimus dorsi does not afford sufficient exposure, because of the unusual outward projection of the muscle, its outer border may be limitedly incised, at a right angle to its fibers as shown in Fig. 4408, which, of course, modifies, to this extent, the strict intermuscular feature of the operation. In ordinary cases, requiring but limited exposure, however, this in-cutting of the latissimus is not necessary.)

This retraction of the latissimus exposes the areolar tissue covering the superior trigone, which itself is the fascia lumbodorsalis (or lumbar fascia)

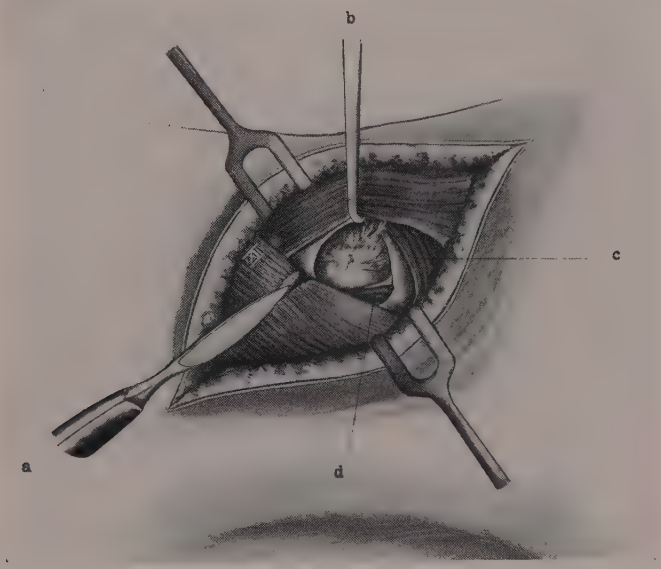


Fig. 4408.—Extraperitoneal, Intermuscular Exposure of the Kidney by the Lumbar Route: _ a, Incising the latissimus dorsi, where it is necessary to secure more room (modifying, to this extent, the intermuscular feature); _ b, retraction of the external oblique; _ c, internal oblique; _ d, quadratus lumborum, exposed through the incised lumbar fascia. The fatty areolar, perinephritic tissue is seen in the center of the wound.

_ the upper part of which is reinforced by the lumbocostal ligament and by the arcuate ligament. The aponeurosis forming the floor of the trigone is now opened _ which may be accomplished by boring through it with a pair of closed forceps, whose blades are opened in the act of withdrawal _ or by being first carefully incised (v. Fig. 4408), after which the forceps may be introduced and separated. Fatty connective tissue usually bulges through this opening, which may be increased by introducing two fingers and practising traction in opposite directions _ or by Mayo scissors. This blunt or combined blunt and sharp dissection is carried on until the opening will admit of the introduction of the hand. In addition to the latissimus dorsi, external oblique, and internal oblique, already exposed, when the incised lumbar fascia (aponeurosis of the trigone) is retracted, the outer border of the quadratus lumborum

is brought into the field (Fig. 4409). From beneath the lower part of the quadratus lumborum the ventral branch of the first lumbar nerve or the two branches of the ventral division, the iliohypogastric and the ilio-inguinal, emerge, coursing downward, forward and mediad, and should be preserved from harm. Along the upper boundary of the wound, outside of the lumbar trigone, the twelfth nerve, or a cutaneous branch from it, is sometimes exceptionally encountered. The sectional view of the kidney, pararenal fat, and retracted muscles at this stage is shown in Fig. 4410.

The surface of the kidney is exposed by bluntly dissecting from it the pararenal fatty areolar tissue (retroperitoneal fat) and the perirenal fat (fatty capsule proper). The beginning of this blunt dissection of the pararenal and perirenal tissue (the two layers of fatty areolar tissue being separated by the

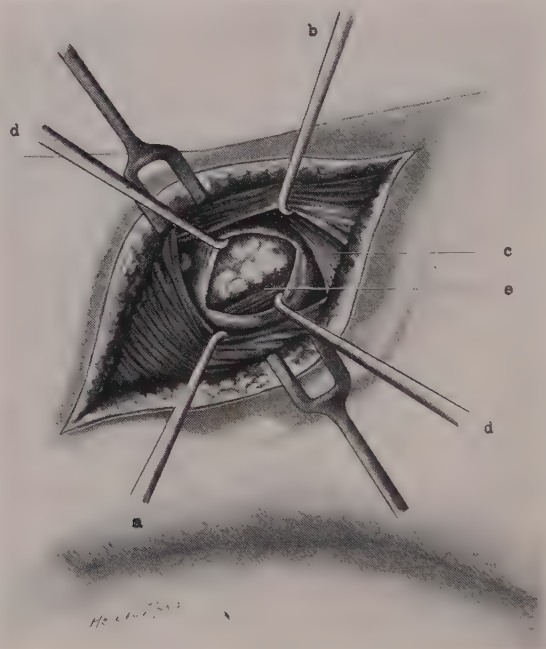


Fig. 4409.—Extraperitoneal, Intermuscular Exposure of the Kidney by the Lumbar Route: – a, Retraction of the latissimus dorsi; – b, retraction of the external oblique; – c, internal oblique; – d, d, margins of the split lumbar fascia retracted; – e, quadratus lumborum.

retrorenal fascia) may be made with Mayo scissors – and the final freeing by the fingers (Fig. 4410). Only small vessels, from the subcostal and first lumbar, supply this connective tissue, the bleeding from which generally soon ceases spontaneously. Any excess of the pararenal and perirenal areolar tissue may be trimmed away with scissors (Fig. 4411). It will be seen by referring to Fig. 4410 that the peritoneal cavity approaches most nearly to the field of operation upon the outer aspect of the kidney, so that in gaining access to the kidney it is safer to make the opening by blunt or sharp dissection through that part of the pararenal and perirenal connective tissues which lies nearer the border of the quadratus lumborum, than toward the outer aspect of the space, and proceeding inward toward the pedicle of the kidney – and especially on the left, where the peritoneal reflection extends further backward. (Sometimes, in loose kidneys, there is actually a mesonephron.)

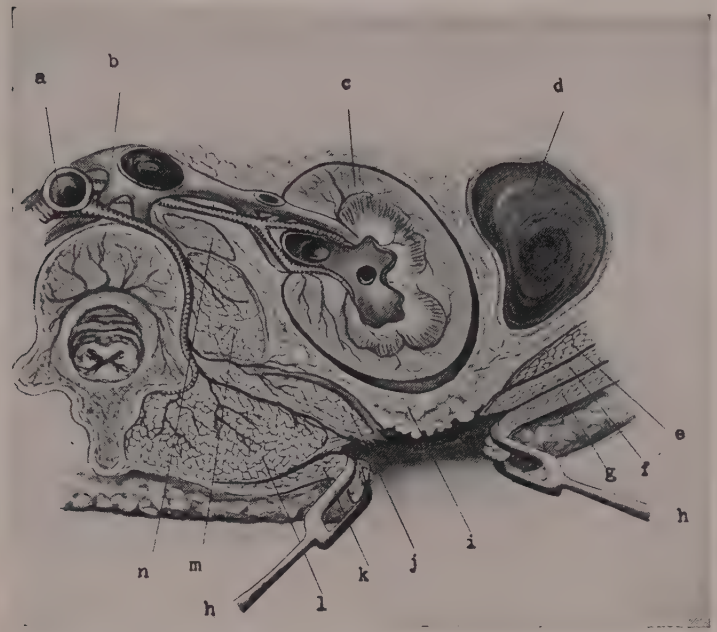


Fig. 4410.—EXTRAPERITONEAL, INTERMUSCULAR EXPOSURE OF THE KIDNEY, SHOWING THE RETRACTED MUSCLES AND THE UNDERLYING STRUCTURES *in situ:* **a,** Aorta and renal arteries; **b,** vena cava and renal veins; **c,** kidney; **d,** ascending colon; **e,** transversalis muscle; **f,** internal oblique; **g,** external oblique; **h, h,** retractors of external oblique and latissimus dorsi, exposing Petit's triangle; **i,** paranephritic and perinephritic fatty, areolar tissue; **j,** quadratus lumborum muscle; **k,** latissimus dorsi muscle; **l,** sacrospinalis muscle; **m,** psoas major; **n,** psoas minor. (Modified from Kelly and Burnham.)



Fig. 4411.—FREEING THE FATTY AREOLAR TISSUE FROM THE KIDNEY; By clamp retraction and by blunt dissection with the fingers. Scissors are trimming away the excess of this fatty connective tissue.

After exposing the kidney, and freeing it from its surrounding fatty capsule, by digital manipulation, it is necessary to deliver it sufficiently into, or out of the lumbar wound, before the special procedure for which the operation was performed, is carried out, and the degree of this delivery will depend upon the object of the particular operation. While the intermuscular method does not give necessary room in complicated cases, the hand may usually be carried through the resulting opening, and the kidney brought out through it, in simple ones. Even when the operation is begun as an intermuscular one, however, rather than risk tearing the kidney substance, or lacerating the important structures of its pedicle, additional room must be secured by as free division of neighboring and restraining muscular and aponeurotic structures as may be needed.

Before the kidney can be brought down from behind and above the last rib, and delivered into the wound, it must be everywhere freed from its perirenal fatty bed, from and including its upper and lower poles, back to its pedicle (of renal artery, vein, and ureter). It is only after this freeing has been accom-

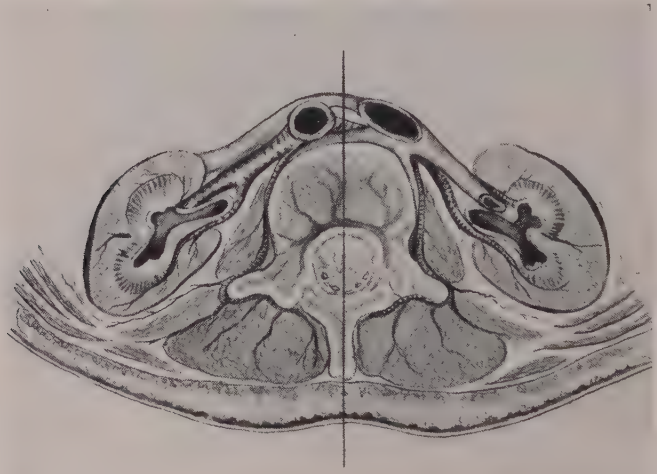


Fig. 4412.—Normal Relations of Aorta, Vena Cava, and Renal Vessels, with the Kidneys in Their Usual Position. (Figures 4412 to 4414 modified from Kelly and Burnham.)

plished, and a sufficiently free wound prepared for its exit, must delivery be undertaken. This is of the greatest importance, for, in the unwise attempts to accomplish the delivery of the kidney, the organ has been both badly lacerated and also torn from its pedicle, with fatal hemorrhage. The ease with which damage of this sort may be done is readily conceivable by referring to Figs. 4412 and 4413 – where it is shown how the kidney may be literally pulled away from its pedicle by injudicious traction, especially where the pedicle may be shorter than usual. In connection with the illustration just quoted, Kelly and Burnham have emphasized the fact that, owing to the arrangement of the anchoring of the aorta by the lumbar arteries (longer on the right than on the left), and of the vena cava by the lumbar veins (longer on the left than on the right), the aorta can be drawn further, with greater safety, through a left lumbar incision than through a right-sided one – while the vena cava can be drawn further, with greater safety, through a right lumbar incision than through a left-sided one. Counterbalancing this arrangement, however, the right renal artery is longer than the left renal artery – and the left

renal vein is longer than the right renal vein. The renal veins are in greater danger than the renal arteries, especially if there be more than one renal vein

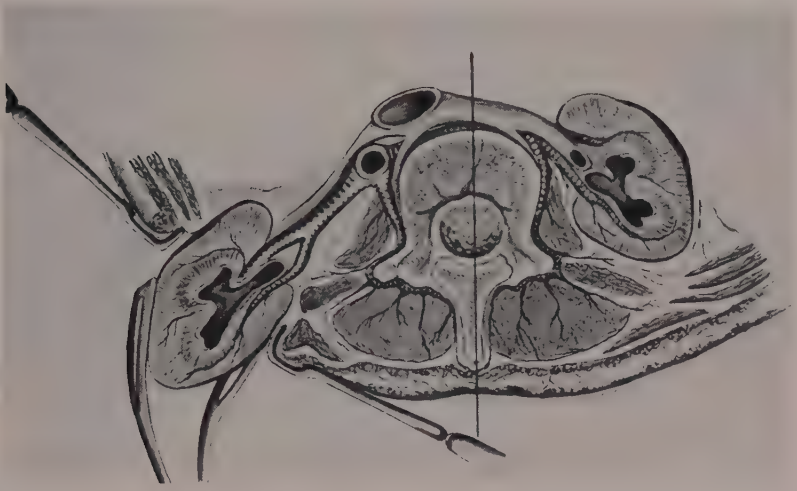


Fig. 4413.—Delivery of the Left Kidney Through a Lumbar Incision – illustrating the left lateral displacement and tension upon the aorta, vena cava, and renal vessels.

– and the Surgeon should be reasonably assured by digital palpation that not too much tension upon the renal vessels is being exercised in the act of delivering a kidney.

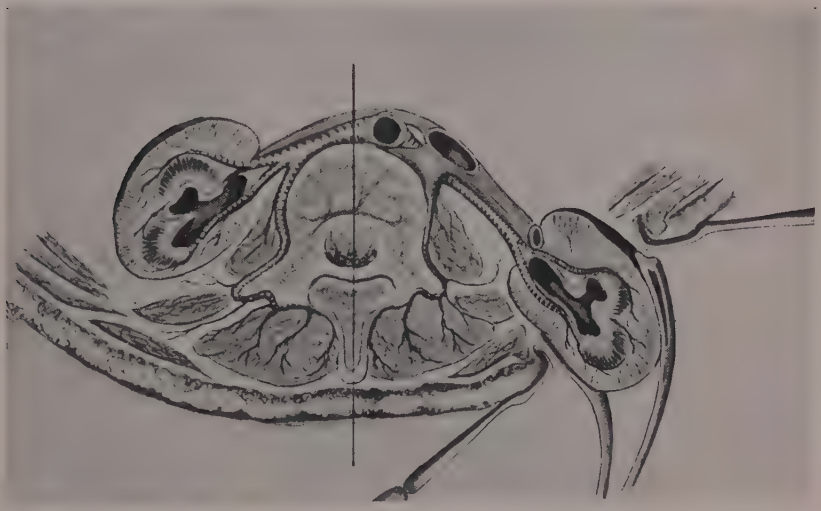


Fig. 4414.—Delivery of the Right Kidney Through a Lumbar Incision – illustrating the right lateral displacement and tension upon the aorta, vena cava, and renal vessels.

The suprarenal bodies retain their connection to the surrounding tissues, when the upper pole of the kidney has been properly freed from its fatty bed – and is not drawn into the wound when the kidney is delivered, except to the limited extent which their connection with the renal vessels entails.

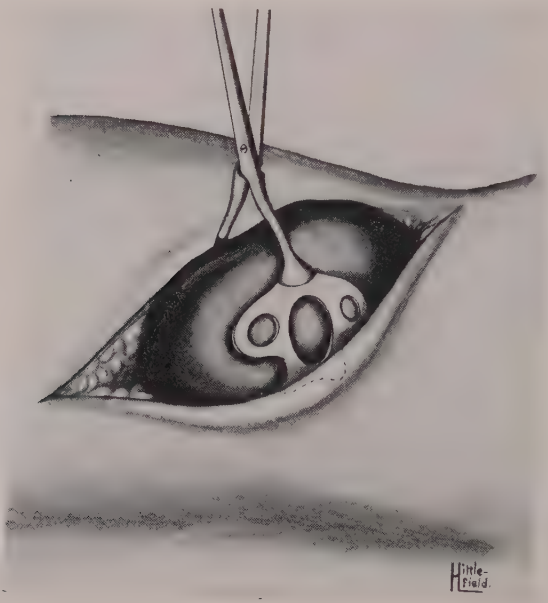


Fig. 4415.—Delivery of the Kidney Through the Lumbar Wound with Special Kidney Forceps.



Fig. 4416.—Delivery of the Kidney Through the Lumbar Wound by Means of the Fingers of One or of Both Hands.

The kidney is best delivered with special forceps – which first seize it and draw it downward in the wound, from behind the last rib – and then deliver it into or through the lumbar wound (Fig. 4415). The dislodgment and

delivery of the kidney may also be accomplished by the Surgeon's fingers (Fig. 4416). If the kidney be only delivered partly through the wound, it may be held in accessible position by packing a strip of gauze beneath both poles. If it is to be brought entirely outside of the wound, it is convenient to let each

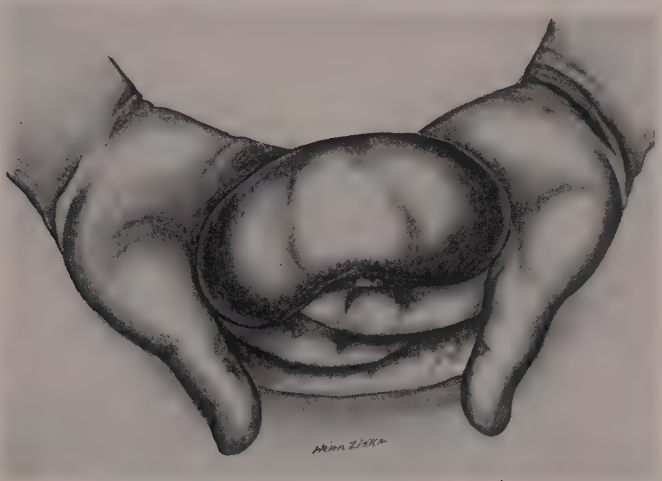


Fig. 4417.—Digital Compression of the Vessels of the Kidney in Exposing the Organ for Operation; _ The two fingers on either side may be either superimposed, the one above the other, as here shown _ or laterally, the one outside the other.

pole rest upon a warm, wet towel stretched across the upper, and another across the lower part of the lumbar wound, between the wound and the under surface of the kidney. The tendency of the margins of the lumbar wound to come together, thereby grasping the pedicle of the kidney, also forms a shelf for it to rest upon.



Fig. 4418.—Clamp Control of the Pedicle During Operation Upon the Kidney.

In some operations, especially where bleeding is anticipated from an incised kidney, some form of hemorrhage control is necessary. This may be accomplished digitally, in the manner shown in Fig. 4417 _ or, better, and with less encroachment upon the field of operation, by a special pedicle clamp, as seen in Fig. 4418.

The kidney, thus delivered, is subjected to the special form of procedure for which the operation was performed _ at the end of which the lumbar wound is usually either closed throughout, or partially closed, with temporary drainage (to provide for the escape of vascular ooze which is so often pronounced in these cases immediately following operation). In closing the wound muscles which have been markedly displaced should be held in contact with buried chromic sutures _ and if any incision of muscles have been added to the strictly intermuscular technic, such incised muscles should have their cut margins approximated by chromic catgut sutures. If a drain be used, it should pass down to the kidney substance _ and, in uninfected cases, can generally be withdrawn in twenty-four or thirty-six hours, and the suture placed

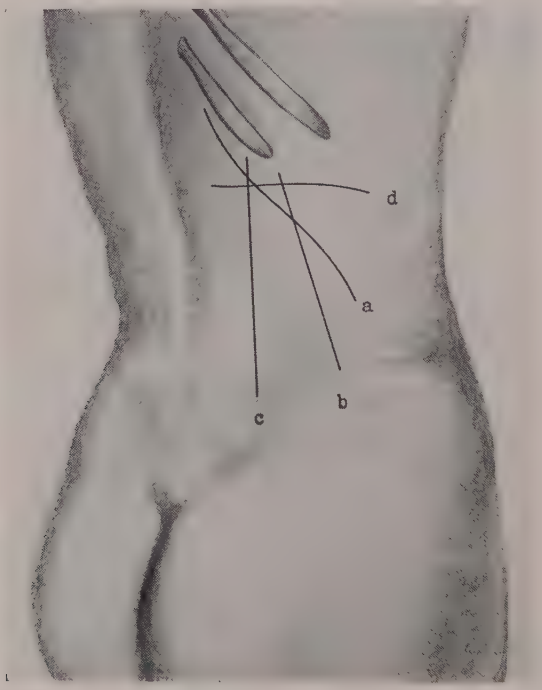


Fig. 4419.—Some of the Incisions Employed in Exposing the Kidney: _ c, Simon's; _ b Czerny's; _ a, Bergmann-Israel's; _ d, Pean's.

but untied, for its passage, then tied. A thick lumbar wound is closed by buried chromic catgut sutures of the deeper layers, and silkworm sutures of the skin _ up to the exit of the drain.

Other incisions for exposing the kidney are seen in Fig. 4419.

RETROPERITONEAL, INTRAMUSCULAR EXPOSURE OF THE KIDNEY BY THE LUMBAR ROUTE

Description.—The kidney is here exposed by splitting the broad overlying abdominal muscles in the line of their cleavage, followed by the retraction of the split margins, without the transverse division of muscle structure _ the procedure corresponding with the "grid-iron" intramuscular exposure of the appendix by the McBurney technic. This method of operating may be regarded

as furnishing an intermediate grade of exposure – more extensive than in the intermuscular operation just mentioned – and less extensive than in the transmuscular operation to be next described.

Preparation – Position – Landmarks.—As in the intermuscular operation (p. 302).

Incision.—Begins over the twelfth rib, at the junction of the rib with the outer border of the sacrospinalis (erector spinæ) – and passes in the cleavage line of the external oblique, in a straight line, obliquely downward, to a point just above or in front of the anterior superior iliac spine.

Operation.—On deepening this incision through skin and fascia, the external oblique muscle is encountered – its cleavage corresponding practically with the superficial cut – and its fibers are separated in their cleavage line from the end of the last rib and the anterior superior iliac spine (Fig. 4420).

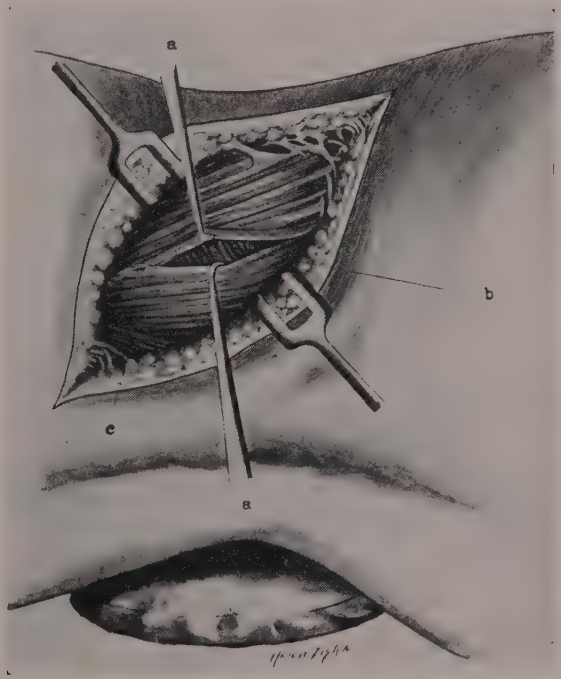


Fig. 4420.—Extraperitoneal, Intramuscular Exposure of the Kidney by the Lumbar Route, Requiring a Field of Intermediate Size: – a, a, Separation of the fibers of the external oblique; – b, internal oblique; – c, latissimus dorsi.

Similarly, the fibers of the muscle next in order, the internal oblique, are separated and retracted in their cleavage line, through their entire extent, from the ninth rib cartilage to the center of the iliac crest (Fig. 4421) guarding the underlying subcostal nerve and vessels.

Lastly, the transversalis is encountered beneath the internal oblique – and its fibers are separated in their cleavage (Fig. 4422) guarding the first lumbar nerves and vessels, lying between the internal oblique and transversalis.

After dividing the transversalis fascia the pararenal and perineal areolar tissues (the two latter separated by a denser renal fascia) are opened up – just as described in the intermuscular form of operation – and the kidney exposed (Fig. 4423).

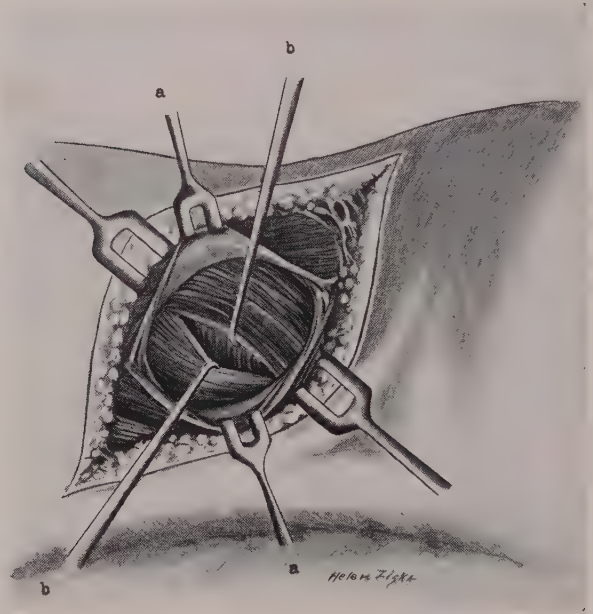


Fig. 4421.—Extraperitoneal, Intramuscular Exposure of the Kidney by the Lumbar Route: – a, a, Retractors of the external oblique; – b, b, retractors of the split fibers of the internal oblique. The fibers of the transversalis are seen in the depth of the wound.

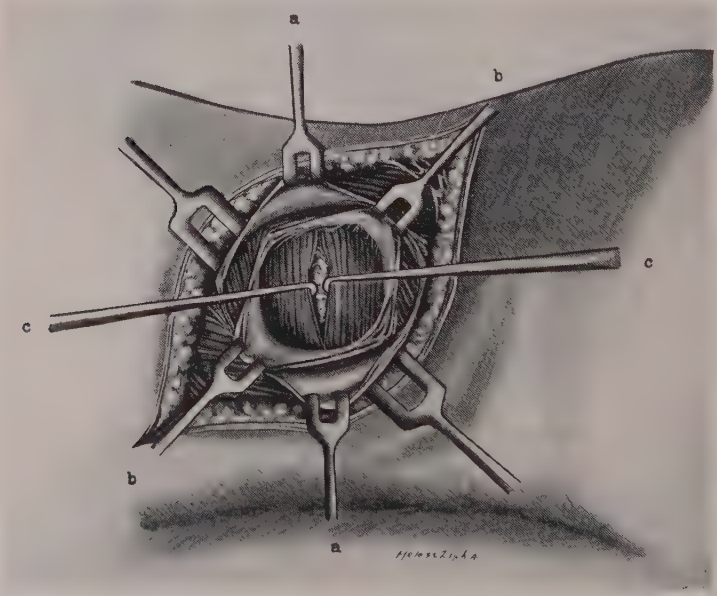


Fig. 4422.—Extraperitoneal, Intramuscular Exposure of the Kidney by the Lumbar Route: – a, a, Retracted margins of the split external oblique; – b, b, retracted margins of the split internal oblique; – c, c, retracted margins of the split transversalis.

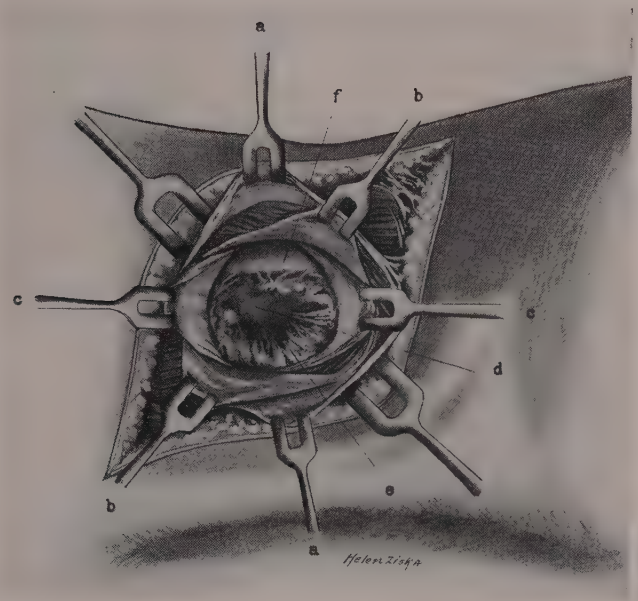


Fig. 4423.—Extraperitoneal, Intramuscular Exposure of the Kidney by the Lumbar Route: – a, a, Retraction of split external oblique; – b, b, retraction of split internal oblique; – c, c, retraction of split transversalis. The kidney, d, is seen through the bluntly dissected areolar tissue overlying it; f, descending colon.

From the stage of exposing the kidney, its freeing and delivery into the wound are accomplished exactly as described under the last operation – as is also the final closure of the wound.

RETROPERITONEAL, TRANSMUSCULAR EXPOSURE OF THE KIDNEY BY THE LUMBAR ROUTE

Description.—In this form of exposure, while regard is had for intermuscular lines and for muscular cleavage lines, no natural arrangement of muscle insertion or arrangement of muscle-fibers is allowed to stand in the way of as freely exposing the parts as may be indicated, even though this involve the oblique or transverse division of muscles, and when this can only be accomplished by such division. This method admits of the maximum exposure of the kidney region, and is usually indicated in extensive involvements, as in large tumors of the kidney, with surrounding adhesions and other complications.

A practical feature of the method is that its possible scope, through subsequent enlargement, if necessary, covers almost every range of complication which may be encountered, from the upper pole of the kidney, along the ureter, to the bladder. The incision admits of being extended upward and backward, over the twelfth and eleventh ribs, exposing them for partial excision, if needed – as well as obliquely downward, toward the anterior superior iliac spine – and onward and downward just above and parallel with Poupart's ligament, exposing, if need be, the entire length of the ureter – the parts being exposed, throughout, extraperitoneally.

Preparation – Position.—See General Surgical Considerations.

Landmarks.—Twelfth rib; outer border of erector spinæ (sacrospinalis); iliac crest; Poupart's ligament.

Incision.—Begins in the triangle made by the lower border of the twelfth rib and the outer border of the erector spinæ _ at a point about 1.3 cm. ($\frac{1}{2}$ inch) below the twelfth rib, and just to the outer border of the erector spinæ (which crosses the twelfth rib about 6.3 cm. [$2\frac{1}{2}$ inches] from the median line) _ passes thence obliquely downward and forward in the direction of the anterior superior iliac spine, generally at first for 7.5 to 10 cm. (3–4 inches) _ and may be subsequently extended both upward and downward as mentioned. When so continued downward, it passes to within 2 to 2.5 cm. ($\frac{3}{4}$–1 inch) of the anterior superior ilac spine, and thence turns downward and inward parallel with and about the same distance above Poupart's ligament. The upper part of the incision, when extended above the lower border of the twelfth rib, must be deepened very carefully, owing to the possibility of incising both pleura and diaphragm. The incision for exposing the kidney proper is seen in Fig. 4405 _

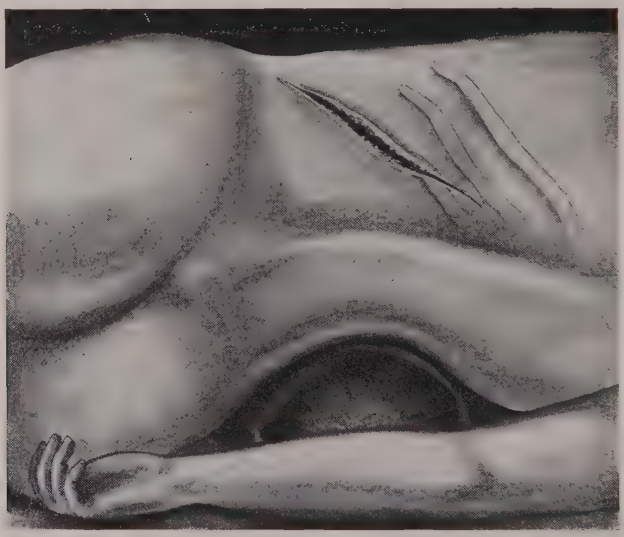


Fig. 4424.—Extraperitoneal, Transmuscular Exposure of the Kidney by the Lumbar Route, Requiring the Maximum Field; _ The incision begins, superficially, in the last intercostal space, above the middle of the twelfth rib _ and extends forward and downward, toward, approximately, a midpoint between the center of the iliac crest and the anterior superior iliac spine. If it be needed to secure more room, or expose the ureter, extraperitoneally, the lower end of this incision may be extended still further downward, parallel with Poupart's ligament. Or if more room be required at the upper end of the wound, the twelfth rib may be excised in part or totally.

and for its continuation, to expose the ureter, see Fig. 4419, A and B _ and also Fig. 4424.

Operation.—Incise skin and superficial fascia, exposing the posterior layer of the lumbar fascia, the anterior part of the latissimus dorsi, and the posterior part of the external oblique. Continuing the incision in the original line, the anterior portion of the latissimus dorsi will be incised transversely to its fibers (Fig. 4425). The upper part of the serratus posticus inferior will be incised transversely beneath it. The posterior border of the external oblique will be divided, and, if the incision be continued far toward the iliac crest, the knife will pass into the intermuscular cleavage line of this muscle.

The outer border of the erector spinæ is exposed, but its sheath is not opened. The internal oblique is incised nearly at a right angle to its course. The posterior aponeurosis of the transversalis muscle (fascia lumborum) is divided

also to the full length of the wound. Between the internal oblique and transversalis branches of the last dorsal nerve and last intercostal artery may be encountered passing downward and forward near the twelfth rib _ and branches of the first lumbar nerve and last lumbar artery near the iliac crest. The nerves are retracted wherever possible. The arteries are ligated with catgut. All the parts are retracted as divided.

The outer border of the quadratus lumborum muscle and the anterior layer of the fascia lumborum are now encountered. The latter is incised to the limit of the wound. The outer border of the former is retracted _ or may be

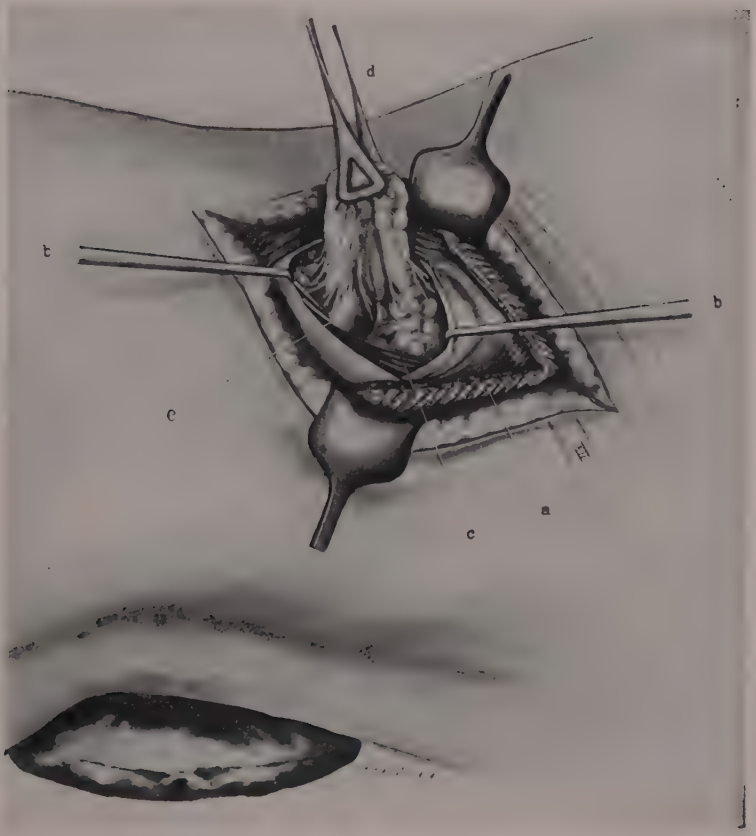


Fig. 4425.—Extraperitoneal, Transmuscular Exposure of the Kidney by the Lumbar Route Requiring the Maximum Field: _ a, Margin of extensively divided latissimus dorsi; _ b, b, divided lumbar aponeurosis retracted; _ c, exposed margin of the quadratus lumborum; _ d, fatty areolar perinephritic tissue; _ e, kidney.

limitedly incised if necessary. This divided layer is also retracted. The fascia transversalis is thus exposed, and is similarly divided _ when the entire depth of the wound is well retracted on each side (Fig. 4426).

The fatty areolar capsule of the kidney is now exposed, retroperitoneally _ and is opened up, partly by careful incision and partly by blunt dissection of the perirenal tissue.

After opening the pararenal fatty connective tissue, and freeing the perirenal areolar tissue from the kidney by blunt dissection (v. Fig. 4425), the

organ is delivered into or out of the lumbar wound in the same manner as described in the intermuscular exposure (p. 302). The special object of the operation is then carried out _ and the wound closed as already described.

Comments.—After the incision has passed through the superficial parts and reached the plane of the muscles, the latissimus dorsi is encountered posteriorly, and the external oblique, anteriorly _ and when these have been divided (the former, transversely, and the latter, more or less in its cleavage), the internal oblique is divided, transversely, and then, under it, the transversalis more or less obliquely. In the upper part of the wound the last dorsal nerve is guarded _ and, in the lower part, the iliohypogastric nerve. If their accompanying vessels are divided, they are tied.

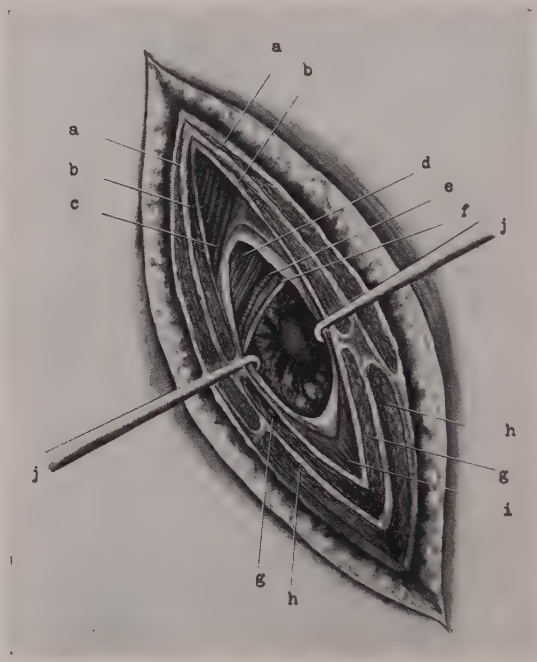


Fig. 4426.—Extraperitoneal, Transmuscular Exposure of the Right Kidney by the Lumbar Route, Seen in Greater Detail: _ **a, a,** Incised margins of the latissimus dorsi; _ **b, b,** margins of the serratus posticus; _ **c,** sacrolumbalis; _ **h, h,** external oblique; _ **g, g,** internal oblique; _ **h,** transversalis; _ **j, j,** retractors of the incised lumbar fascia; _ **e** and **f,** retracted lumbar artery and nerve. (Modified from Doederlein and Kroenig.)

In the upper part of the incision, the safest guide in extending the wound is to first recognize digitally the twelfth rib and the external arcuate ligament (the thickened upper margin of the anterior lumbar fascia, arching across the upper aspect of the quadratus lumborum, from the front of the anterior surface of the transverse process of the first lumbar vertebra, to the lower part of the apex of the last rib) _ after which, and guided by the finger, the wound may be carefully increased by the Mayo scissors. The external margin of the quadratus lumborum is recognized by its position and by the practically vertical course of its fibers.

In delivering the kidney, the lower pole of the organ is first drawn into the wound, and then when the entire structure is displaced downward, the upper pole will glide from in front of the last rib.

Comment.—There is more chance to separate, rather than divide, some of the muscle-fibers in this incision, if it become necessary to extend it, than in angular incisions.

In exploratory incisions, and in limited operations upon the kidney, it is generally only necessary to divide the skin, superficial fascia, lumbar fascia, latissimus dorsi, and serratus posticus inferior over a distance between the anterior border of the erector spinæ and the posterior edges of the external and internal oblique muscles. In thick loins longer incisions are necessary. Where the kidney does not extend down as far as usual, the incision may be extended well over the twelfth rib (but see Surgical Anatomy).

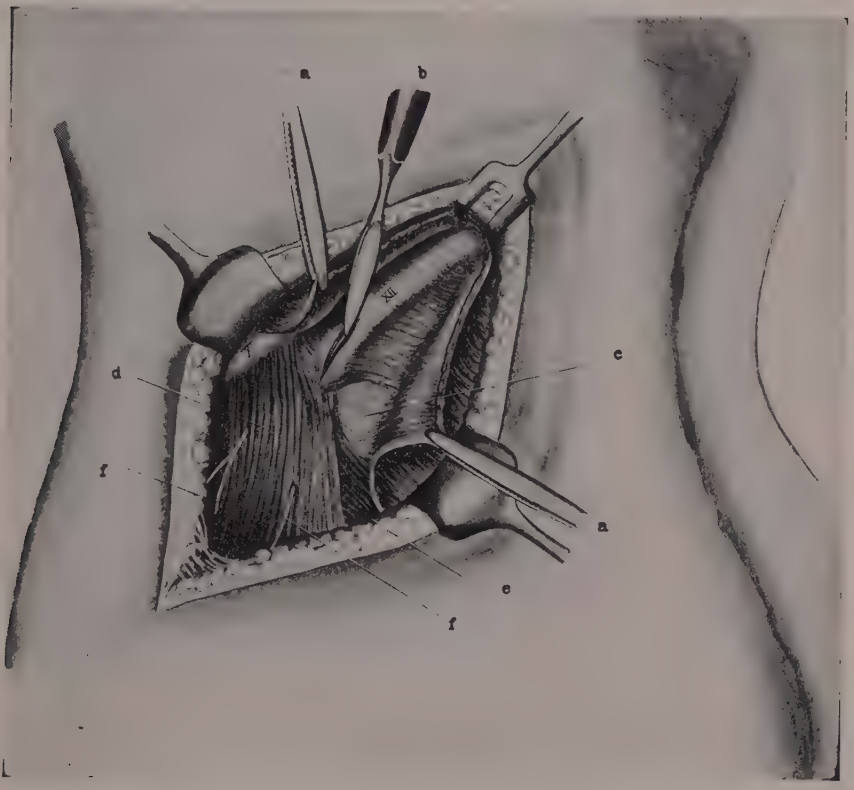


Fig. 4427.—Extraperitoneal, Transmuscular Exposure of the Kidney by the Lumbar Route – with Enlargement of the Space by the Excision of Part or All of the Twelfth Rib: – a, a, Retracted portions of the incised latissimus dorsi; – b, incision through the periosteum of the twelfth rib preparatory to its subperiosteal excision; – c, superior lumbar trigone; – d, external oblique; – e, internal oblique; – f, f, branches of the eleventh and twelfth nerves. (Modified from Kelly and Noble.)

Guard against opening the diaphragm and pleura, which are only separated by a comparatively thin layer of fibrous tissue from the renal fatty tissue at the costolumbar hiatus of the diaphragm.

Proximity of the kidney is sometimes noticed, in approaching from behind, by the finer texture of the fatty areolar tissue near it.

Avoid the colon, which sometimes pushes its way into the wound.

If, in the course of operation, more room be needed, the incision may be extended in one of three directions: – (*a*) backward, dividing, if necessary,

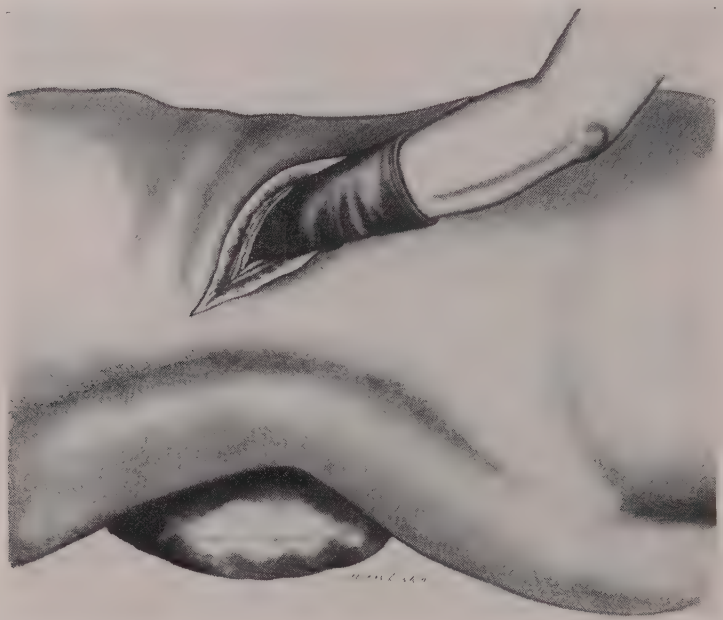


Fig. 4428.—Exploring the Abdominal Cavity During the Exposure of the Kidney by the Lumbar Route; – The hand may be introduced through the lumbar wound and carried downward, extraperitoneally, in order to find and deliver a displaced kidney. Or, through a peritoneal incision, it may be carried transversely into the peritoneal cavity, to examine the opposite kidney, or appendix – or upward, as here, to explore the gall-bladder tract.

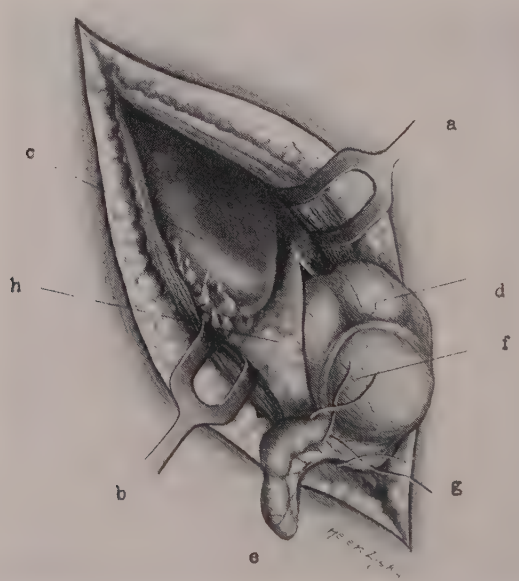


Fig. 4429.—Lumbar Appendicectomy Performed During the Lumbar Exposure of the Kidney – Through a peritoneal incision, made opposite the lower, outer aspect of the kidney, while the muscular and aponeurotic boundaries of the wound are well retracted, the opposite kidney may be examined – or the appendix may be delivered and excised; – a, b, Retractors of the lumbar muscles; – c, right kidney; – h, peritoneal incision; – d, cecum, delivered into the wound; – e, appendix; – g, meso-appendix; – f, ligation of the appendix.

the anterior border of the erector spinæ; – (*b*) upward and backward over the twelfth rib, which may be partially excised (Fig. 4427); – (*c*) downward and forward toward the anterior superior iliac spine, and thence parallel with and about 2.5 cm. (1 inch) above Poupart's ligament.

If it be desired to examine the opposite kidney during operation (which should always be done before removing a kidney, except where that ground has been preliminarily covered by vesical catheterization of the opposite ureter), Kocher resorts to the following technic: – he divides the transversalis muscle sufficiently far forward to expose the reflection of the peritoneum on to the colon, near the posterior axillary line – then he opens the peritoneum and passes his hand through the opening and around to the opposite kidney – the inferior surface of the liver and gall-bladder being thus palpable also (Fig. 4428). After accomplishing the examination the opening in the peritoneum is sutured and the operation continued.

By keeping close to the outer edge of the quadratus lumborum muscle there is minimum danger of wounding the peritoneum in the extraperitoneal manipulations.

In operating upon the right side it is generally possible to deliver the cecum through the opened peritoneum, and excise the appendix, if indicated – the peritoneal incision being made to the lower, outer side of the kidney (Fig. 4429).

RETROPERITONEAL EXPOSURE OF THE KIDNEY

BY KOENIG'S ANGULAR LUMBO-ABDOMINAL INCISION

Description.—A retroperitoneal exposure of the kidney sometimes used where an especially large amount of room is required in complicated cases.

Preparation – Position.—See Surgical Considerations.

Landmarks.—Twelfth rib; outer border of erector spinæ; iliac crest; umbilicus.

Incision.—Begins about 2 cm. ($\frac{3}{4}$ inch) below the twelfth rib, at the outer border of the erector spinæ – passes almost vertically downward (having slight outward tendency) along the outer border of the erector spinæ, to just above the iliac crest – thence curves forward and upward and passes in a straight line toward the umbilicus, stopping at the outer border of the rectus (Fig. 4405).

Operation.—Incise, in the vertical portion of the incision, the skin, superficial fascia, posterior layer of the lumbar fascia, latissimus dorsi, serratus posticus inferior, middle layer of lumbar fascia, quadratus lumborum, anterior layer of lumbar fascia, and subperitoneal fatty areolar tissue. The vessels and nerves encountered in this portion of the incision are the same as those in the oblique lumbar incision.

The lips of this wound are retracted – the fingers are inserted and the peritoneum detached and pushed ahead in advance of the oblique part of the wound, as it is being made. The oblique portion of the incision is carried out by dividing the skin, superficial fascia, latissimus dorsi, external oblique, internal oblique, transversalis, transversalis fascia, and subperitoneal areolar tissue. All nerves encountered are preserved, by retraction, as far as it is possible. The peritoneum is carefully detached and held out of the way ahead of the incision until its end is reached.

The special operation is accomplished – and the wound treated accordingly.

The perirenal fatty areolar tissue is now opened up and the kidney exposed.

Comment.—This operation gives abundant room, and is retroperitoneal – but is very extensive, and a weakened abdominal wall is apt to follow.

EXPOSURE OF THE KIDNEY BY THE ANTEROLATERAL, PARAPERITONEAL ROUTE

Description.—In this procedure the exposure is made by the anterolateral route, during the steps of which the peritoneal cavity is not incised, but the unopened peritoneum is pealed from the lateral abdominal parietes and displaced forward and inward. The technic gives exposure, both extraperitoneal and very free to both kidney and ureter. The method is particularly indicated in those cases where, in advance of operating, it is surmised that a large, adherent kidney mass, or extensive complications, are apt to be encountered, especially a non-infected tumor mass – or where the ureter, as well as the kidney, must be exposed. In such cases the operation may be begun by simply the vertical portion of the incision in, approximately, the semilunar line, or external to it – and, if more room be needed, forwardly or backwardly directed incisions may be added.

This is in contrast to the situation discovered during an operation begun by an oblique lumbar incision, when it is found that more room is needed – where a forwardly directed transverse incision may be added to the oblique one.

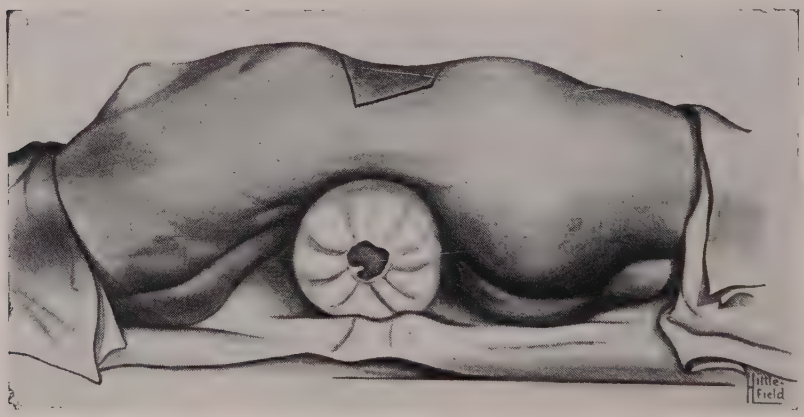


Fig. 4430.—Oblique Dorsal Position for Exposure of the Kidney by Anterior and Anterolateral Incisions. The side of operation is slightly higher. Gregory's incision for the paraperitoneal exposure of the right kidney is here shown.

Preparation.—See General Surgical Considerations, p. 299.

Position.—The patient lies upon his back, with the involved side elevated by and turned slightly forward by a firm cushion placed under the lumbar region of that side (Fig. 4430).

Landmarks.—The linea semilunaris; tips of the eleventh and twelfth ribs; iliac crest.

Incision.—Various incisions, and combinations of incisions, have been employed.

The combination of incision most frequently used is probably the following: – The vertical or primary incision is placed in the semilunar line – and the transverse incision, obliquely curved, parallels the twelfth rib, starting from the posterior margin of the vertical incision, at a point about opposite the umbilicus, and extending in the direction of the lumbar trigone as far as necessary – constituting a laterally placed T-shaped incision, as shown in Fig. 4431.

A vertical incision which admits of either a forward extension above, parallel with the costal arch – or a forward extension below, parallel with

Poupart's ligament – or both – is the following: – The vertical or primary incision begins immediately in front of, and just below, the anterior end of the eleventh rib, and passes, in a straight line, to a point one fingerbreadth above the anterior superior iliac spine – that is, well to the outer side of the semilunar line. If more working room be required than will be furnished by this incision alone, an additional incision may be carried from the upper end of the vertical incision, paralelling the costal arch, and a short distance below it, – or an additional incision may be carried from the lower end of the vertical incision, above and paralleling Poupart's ligament, – or both of these additions may be made (v. Fig. 4430).

Both of these incisions furnish very free extraperitoneal exposures of both kidney and ureter. Their chief drawback is the damage done the nerve supply

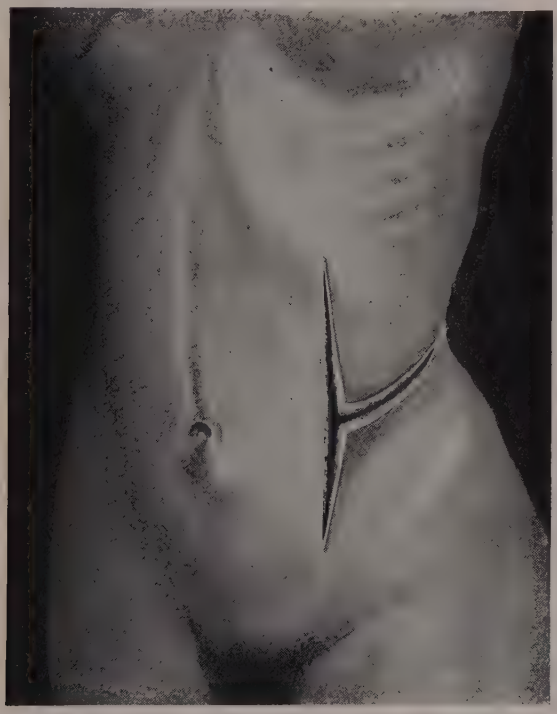


Fig. 4431.—T-shaped Incision for Exposing the Kidney and Ureter by the Anterolateral Paraperitoneal Route – the transverse limb being, approximately, parallel with the twelfth rib – and the vertical limb corresponding with the linea semilunaris. (Seen from above.)

and musculature of the abdominal wall. Every effort should be made to preserve the former and repair the latter – as well as possible.

Operation.—The method of exposing the kidney will be described irrespective of the one of the two forms of initial incision above outlined, adopted – although, in the T-shaped incision, the secondary section is made backward from the primary incision, – and, in the three-sided incision, the secondary cuts are made forward from the primary one. In both, the structures of the abdominal wall are divided down to, but not through, the peritoneum. As soon as the peritoneum is reached, this is carefully stripped from the lateral abdominal parietes, in a backward direction. It is along a line to the outer side of the semilunar line that the separation of the parietal peritoneum can

be most easily accomplished. The separation is carried on by blunt dissection, and is best done by introducing the fingers into the wound, with their tactile pulps inward, and their nails outward – recognizing the cleavage line between the peritoneum and the connective-tissue plane which holds it loosely to the abdominal wall – and, by a careful, backward insinuation of the fingers in this plane, the peritoneum is separated from the lateral abdominal wall back to its forward reflection onto the structures upon the posterior abdominal wall, including the kidney (Fig. 4432, where manipulation in connection with the T-shaped incision of approach is illustrated).

As the separation of the peritoneum from the abdominal wall progresses, the intraperitoneal contents, within the loosened peritoneal sac, are carefully retracted toward the median line – shown in Fig. 4433 (the entry being here made by the three-sided line of incision). The outline of the colon is indicated through the peritoneum. The soft parts which have been displaced mediad

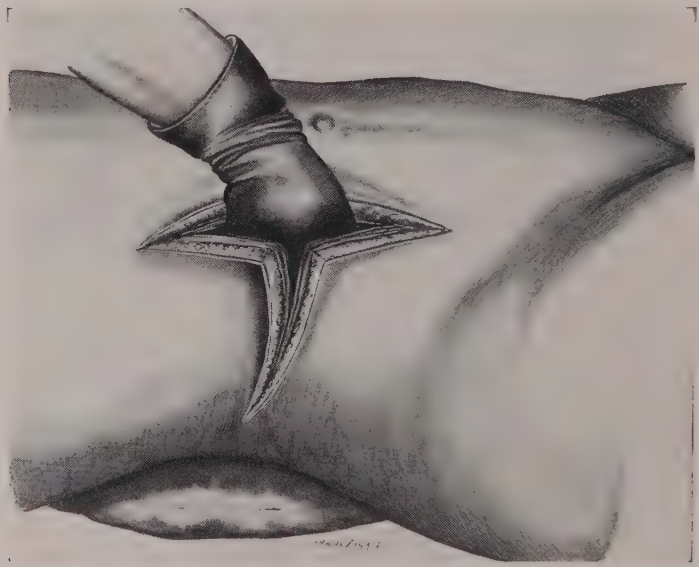


Fig. 4432.—Anterolateral Paraperitoneal Exposure of the Kidney; – Introduction of the hand through the abdominal wound, to free the peritoneum from the abdominal parietes.

are held away from the field of operation by means of pads of gauze under the hold of retractors. Less perirenal fatty connective tissue is encountered surrounding the kidney than in the lumbar approach – but that which is present is separated by blunt dissection, exposing the surface of the kidney. Where it is the case of a renal tumor being exposed for removal, along with the kidney, the fingers are inserted between the perirenal areolar tissue and the quadratus lumborum. The ureter will be found clinging to the posterior surface of the peritoneum, and is usually pulled up from its bed when the peritoneum is raised – as shown in the illustration. The pedicle of the kidney – renal artery, vein, and ureter – must be carefully handled and exposed – and it is only after the pedicle is sufficiently exposed to enable its structures to be clamped in case of emergency is the situation entirely safeguarded, for extensive bleeding prior to this would be awkward to control. In this exposure opportunity to remove the paravascular lymphatic glands is especially well afforded (v. Fig. 4433, f).

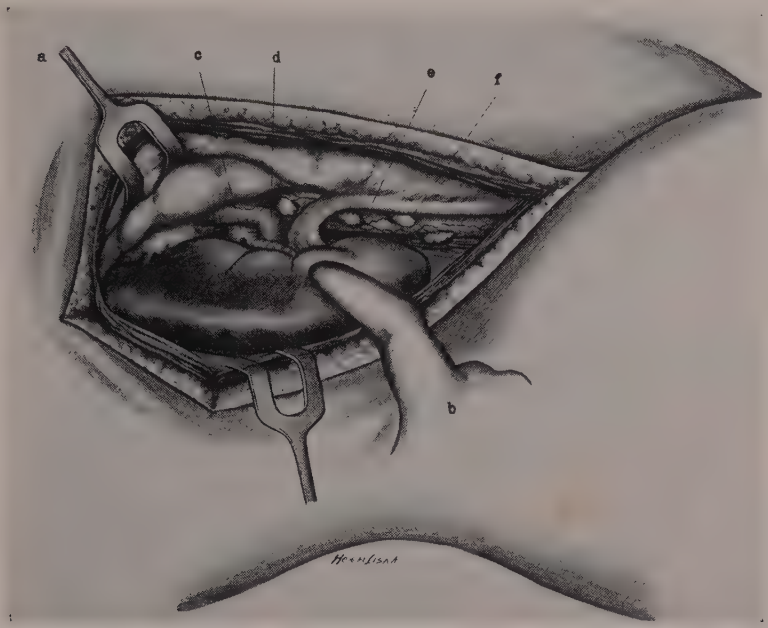


Fig. 4433.—Anterolateral, Paraperitoneal Exposure of the Kidney: – a, Retracting a margin of the angular incision; – b, kidney being depressed in its bed by a finger to increase the exposure of its pedicle; – c, renal artery; – d, renal vein; – e, ureter adherent to peritoneum below and detached from it above; – f, paravascular lymphatic glands. The ascending colon is seen through the unopened peritoneum and, with it, is being retracted mediad.

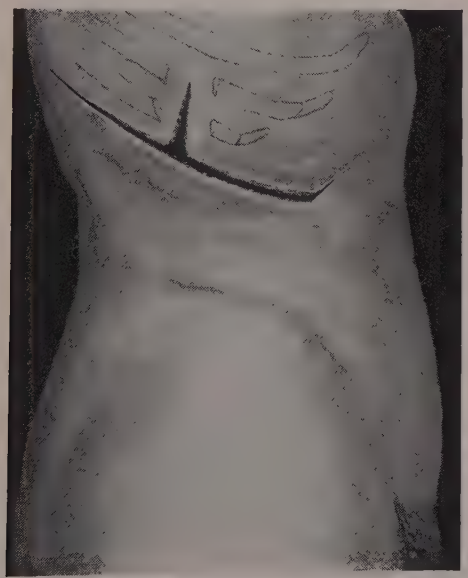


Fig. 4434.—"Barn-door" Incision, with Partial Excision of the Eleventh and Twelfth Ribs, for Exposure of the Kidney by the Anterolateral, Transperitoneal Route – available where extensive room is required in complicated cases, with surrounding adhesions.

The object of the operation is accomplished _ and the abdomen closed. If drainage be indicated, this is accomplished through a counteropening in the lumbar region. As this extensive technic is not, however, usually performed for minor involvements, it is generally the case that the kidney and, often the ureter, are removed (v. p. 406), as the final step preceding closure. When the kidney is removed, it is generally also indicated to then remove the perirenal areolar capsule of the kidney, and the neighboring lymphatic glands _ which are carefully dissected away from the adjacent important vascular structures with extreme care _ but with greater ease through the space given by the previous removal of the kidney.

Comment.—Burnham describes an incision which he states gives excellent exposure to the whole kidney, even though it be complicated by tumor. The approach is by what he terms the "barn-door incision" (Fig. 4434). The incision starts over the superior lumbar trigone, and, passing forward, parallels the twelfth rib and at a distance of about 2.5 cm. (1 inch) below it _ and then turns forward and somewhat upward, parallel with the arch of the costal cartilages. If more room is required than is afforded by this crescentic incision, the last two or three ribs are divided transversely, near the superior lumbar trigone _ thus forming two temporary flaps of the lower chest wall. In his illustration, from which Fig. 4434 is modified, limited excisions of rib substance seem to have been made. It would seem, however, that the advantage of a temporary osteoplastic resection might be secured by simply dividing the ribs, subperiosteally _ and, at the end of the operation, turning the ends back into their normal relationship.

EXPOSURE OF THE KIDNEY BY THE ANTERIOR TRANSPERITONEAL ROUTE

BY VERTICAL INCISION IN THE LINEA SEMILUNARIS—LANGENBUCH'S OPERATION

Description.—An anterior transperitoneal exposure, with division of the outer mesocolon over the kidney. Chiefly indicated in large tumors _ in narrow, deformed lumbar regions _ in thick lumbar regions _ where much room is required _ and as furnishing an easy approach and examination of both kidneys and ureters, in non-infected cases _ and especially in laceration of the kidney. Incision over the linea semilunaris gives a more direct route than incision in the median line. The incision is sometimes made through the outer third of the rectus.

Preparation _ Position.—As for median abdominal section.

Landmarks.—Linea semilunaris; costal arch; umbilicus.

Incision.—Begins just below the border of the ribs, in the linea semilunaris of the affected side, and extends vertically downward in that line for 10 or 12.5 cm. (4 or 5 inches) _ the incision having its center about opposite the umbilicus (Fig. 4435).

Operation.—The abdominal cavity is opened in the usual way and the wound well retracted. The small intestines are held out of the way by gauze pads and special retractors. The hand is introduced and the condition of both kidneys examined. The colon is displaced toward the median line and the outer layer of the mesocolon is incised in a vertical direction over the site of the kidney _ thus avoiding the vessels to the colon (Fig. 4436). The fingers of the surgeon are passed through this incision in the mesocolon down upon the kidney _ the posterior surface of which is then freed and exposed, as it lies in its fatty areolar bed. The special steps of the operation are then concluded (Fig. 4437) _ where excision is shown _ and the abdomen closed. For the details of total nephrectomy by the abdominal route see p. 414.



Fig. 4435.—Incision for the Transperitoneal Exposure of the Kidneys and Ureters by the Anterior Abdominal Route; – On the right is seen a vertical incision through or around (*i. e.*, after retracting) the outer third of the rectus, for the exposure of the right kidney and ureter; – and on the left, a slightly oblique incision in the semilunar line, for the exposure of the left ureter and kidney.

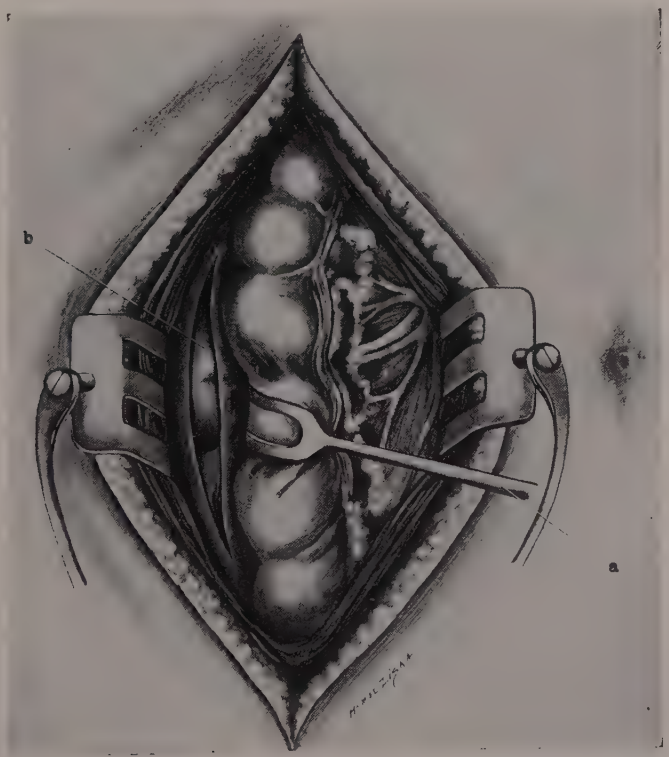


Fig. 4436.—Transperitoneal Exposure of the Kidney by the Anterior Abdominal Route; – The field has been exposed by a vertical incision through the outer third of the right rectus muscle, and the lips of the abdominal wound retracted: a, The ascending colon is being drawn toward the median line; b, the kidney, exposed by an incision through the outer reflection of the mesocolon.

Comment.—Where drainage is necessary in connection with the anterior transperitoneal operation, a counteropening is made in the loin — the incision being made from without upon a sound pressing against the lumbar wall from within.

Where it is necessary, in the anterior operation, to fix a diseased ureter into the lumbar skin, an incision is made by cutting from without upon a pair of forceps introduced from within, near the outer edge of the quadratus lumborum.

Before closing the abdomen the incised wound in the mesocolon is sutured with catgut.



Fig. 4437.—Transperitoneal Exposure of the Kidney by the Anterior Abdominal Route; — The kidney has been delivered through the incision made in the outer leaf of the mesocolon, after retracting the ascending colon mediad. The kidney pedicle, made up of, **a**, the renal artery; **b**, renal vein; and **c**, the ureter, have been clamped, and ligatures applied proximally to the clamp, as though these were about to be tied, and the kidney excised.

If, during the operation, more room be demanded, as in the extensive complications and adhesions of tumors, a transverse cut may be added to the outer margin of the wound — the total incision then simulating that used for the anterolateral paraperitoneal operation (v. p. 323). If, on the other hand, a more limited incision than Langenbuch's will suffice, and with somewhat less damage to nerve structures, the incision may be made through the outer third of the rectal sheath, with retraction of the rectus.

If in the progress of the operation (or it may even be resorted to as a routine) it be desired to close off the general peritoneal cavity from the field of operation, the inner margin of the incised posterior parietal peritoneum, where

it forms the outer leaf of the mesocolon, is sutured to the inner incised margin of the anterior parietal peritoneum _ before proceeding with the operation _ suturing with catgut.

By no chance must the incision be made through the inner leaf of the mesocolon, to the inner side of the colon (ascending or descending, as the case may be), for the blood-vessel supply of the colon would be divided, with consequent necrosis of the bowel. The blood-vessels come through the inner leaf of the mesocolon. It has been pointed out, however, that sometimes the two leaves of the mesocolon are so intimately adherent that it is difficult to avoid wounding the vessels in dividing even the outer mesocolic leaf _ and that this difficulty is more apt to be experienced on the left side. Even in dividing the outer mesocolic leaf, vessels of accompanying tumors may be divided.

The mesocolon of the descending colon, on the left, is shorter and lies further to the outer side, than is the case with the mesocolon of the ascending colon, on the right _ so that manipulations about the kidney through an anterior transperitoneal approach are somewhat more difficult on the left side.

The outer mesocolic leaf is sometimes divided transversely outward, which makes less likely the wounding of vessels which may be accidentally present, or the normal vessels, when the two mesocolic leaves are intimately adherent, but furnishes less room for manipulation than does the incision parallel with the bowel.

Rather than permanently closing off the field of operation from the peritoneal cavity by the method of suturing above described, it is better, if desired, to temporarily employ the technic during the operation, and then, at the end of the operation, cut away this suturing _ establish, if need be, posterior translumbar drainage _ suture together the lips of the incised mesocolic peritoneum, restoring the integrity of the posterior parietal peritoneum _ and then, in closing the anterior abdominal wound, suture together the margins of the anterior parietal peritoneum in the usual manner.

TRANSPERITONEAL EXPOSURE OF THE KIDNEY

BY MEDIAN ABDOMINAL SECTION

Description.—Exposure of the kidney by an incision in the median line. Practically the same as exposure by vertical incision in the linea semilunaris, except for the position of the incision _ the operation last described giving the most direct access to the kidney.

Preparation _ Position _ Landmarks _ Incision.—As in median abdominal section.

Operation.—Essentially the same as in exposure by the vertical incision in the linea semilunaris, or through the outer third of the rectus. Having displaced the intestines to the opposite side, the mesocolon is divided to the outer side of the kidney. The lateral layer of the mesocolon should be divided. If circumstances make this inconvenient, the median layer of the mesocolon is divided transversely and limitedly, between vessels. Having passed through the opening in the mesocolon, the kidney is isolated and exposed _ its anterior surface, lateral borders, upper and lower poles, posterior surface, and pelvis being made accessible. Having accomplished the object of the operation, the incision in the mesocolon is sutured _ and the abdomen closed.

Comment.—Wherever the fatty areolar capsule has been opened up very extensively in exposing the proper capsule of the kidney, at the close of the operation the fatty areolar connective tissue is sutured about the kidney again _ and, if necessary, anchored, by a chromic gut stitch or two, to the neighboring structures.

The inner leaf of the mesocolon should not be incised if avoidable, and if unavoidable, the mesocolic leaf must be carefully cut between vessels and parallel with them.

EXPOSURE OF THE KIDNEY BY THE COMBINED ABDOMINOLUMBAR OPERATION

BY ANTERIOR TRANSPERITONEAL AND POSTERIOR RETROPERITONEAL INCISIONS

Description.—Consists of one of the anterior transperitoneal operations combined with one of the posterior retroperitoneal operations. Generally resorted to only where it is wished to make a previous examination of the abdominal cavity, chiefly for diagnostic purposes connected with both kidneys and ureters _ or where a large tumor is to be removed. The intra-abdominal operation is first performed. Guided by one hand within the peritoneal cavity, the kidney can be exposed through a smaller lumbar wound, and with greater ease, and with less danger of wounding the colon and peritoneum. The great objection, however, is the double operation _ and the involvement of the peritoneal cavity, if infection be present.

Preparation.—As for both the abdominal and lumbar operations.

Position.—Patient is supine during the anterior operation, and partly upon the side during the lumbar incision. The surgeon's position changes with the steps of the operation.

Landmarks.—Those of both the abdominal and lumbar operations.

Incision.—The incisions usually adopted are, for the anterior operation, Langenbuch's vertical incision in the linea semilunaris _ and, for the posterior operation, the oblique lumbar incision. See the descriptions of these incisions, pages 326 and 302.

Operation.—The abdominal operation is first done _ the examination made _ and then, guided by the left hand within the abdomen, the lumbar incision is made and the operation completed extraperitoneally, accomplishing the special object sought through the posterior wound, as a rule _ after which the abdomen is closed. The posterior wound is either entirely closed _ or partially closed and drained as indicated. The peritoneum is everywhere closed.

ABNORMALITIES OF THE KIDNEYS

These are many _ and are dealt with fully in special writings limited to the kidneys. They will, therefore, not be dealt with here _ other than to mention the general directions in which deformities of the kidneys occur.

Departures from the normal in the development of the kidneys are encountered under the following headings: _ Abnormalities in Number _ Abnormalities of Form _ Abnormalities in Position _ Abnormalities of Blood-vessels _ Abnormalities of Ureters _ and in some of these main divisions of deformities there are many subgroups.

One of the commoner forms of kidney deformity is horseshoe kidney _ found once in every 1100 cases, according to Kuester _ an abnormal fusion occurring in embryonic life with the isthmus either above, or below _ the latter type being shown in Fig. 4438.

OPERATION FOR PERINEPHRITIC ABSCESS

Description.—Perinephritic abscess is the result of infection and suppuration of the perirenal fatty areolar tissue of the kidney _ which distinctly calls for early incision for the evacuation of pus, followed by drainage of the pus space. It is better still if the infected region can be laid open before pus has actually formed, and further damage avoided.

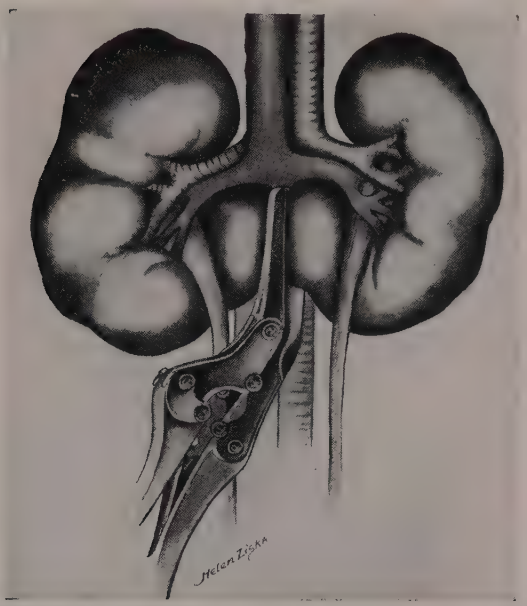


Fig. 4438.—Operation for Separating Horseshoe Kidneys; – The isthmus is crushed by angiotribe, after which it is divided between double ligatures. (Modified from Rovsing.)

Operation.—The perirenal region should be exposed through the superior lumbar trigone, by an oblique lumbar incision, such as employed in exposing the kidney by this route – the details of which have been described and pictured (v. pp. 315–321). If the perirenal abscess be of considerabe size, and have broken through the retroperitoneal fat, it may penetrate the more superficial fascia and then make its appearance beneath the skin of Petit's triangle – so that in the case of a large abscess of this type, an incision placed somewhat lower, and more anteriorly, may be used – and for such an incision as would cover this last contingency, see Fig. 4419, p. 312. The dissection is finally deepened parallel with the outer border of the quadratus lumborum. Three distinct connective-tissue planes are opened up – superficial, deep, and perirenal.

Following the free evacuation of pus, ample drainage of the tract is provided – by rubber tube or by gauze – and the perirenal and lumbar wounds caused to heal from the bottom. Any excess of lumbar wound, over and above that needed for drainage, may be closed from the ends.

Comment.—The abscesses considered above are those which are, primarily, perinephritic abscesses – and not those which are secondary perinephritic abscesses, from primary nephritic, or, for instance, gall-bladder-tract abscesses, rupturing into the perinephritic tissues. The radical and surgical treatment of all abscesses pivots of course upon attacking the initial source of infection.

It must not be concluded that suppuration is not present in the vicinity simply because evidence of its presence is not forthcoming as soon as the perirenal tissues are laid open – for not until the finger has been passed up under the diaphragm, around the contour of the kidney, and over the pelvis and upper part of the ureter, is it warrantable to conclude, in the presence of suggestive phenomena, that pus is not present.

While, as mentioned above, a perirenal abscess may be secondary to an abscess elsewhere in the neighborhood – so, on the other hand, while a peri-

nephritic abscess may, itself, be primary, both in nature and time, it may be quite secondary in importance to another suppurative process started by its presence — as in the case of a perinephritic abscess rupturing into the peritoneum.

EXPLORATORY PUNCTURE OF THE EXPOSED KIDNEY

Description.—The only puncture of the kidney that is strictly surgical is that which is made after the organ has been exposed in the wound. Formerly, the kidney was often punctured through all the overlying soft parts. And when this was done, as was often the case, the day in advance of operation,

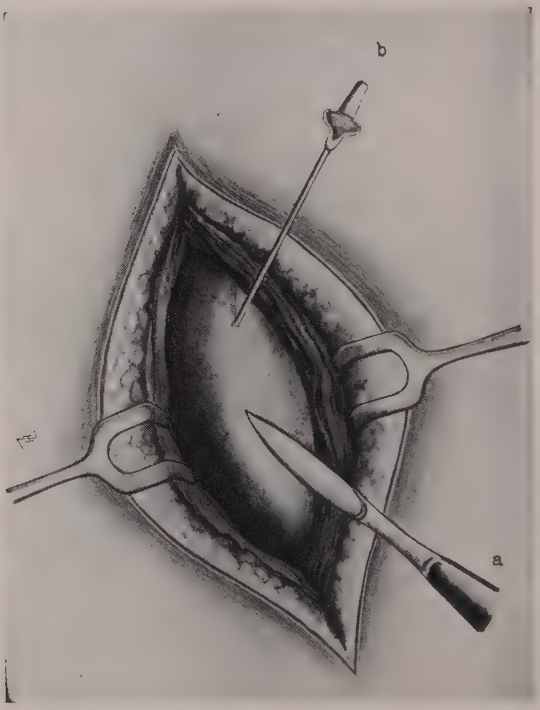


Fig. 4439.—Exploration of the Kidney Substance and Pelvis: — b, Exploratory needle puncture made through the kidney substance after the organ is exposed in the wound; — a, incision through the substance of the kidney (nephrotomy) to the site of pus located by needle — or as a primary and independent exploratory section.

when pus was present time was given for much mischief to have taken place — with the addition of paranephritic to intranephritic infection. Exploratory puncture of the kidney through the soft parts is not even warrantable even though the patient be upon the table and in readiness for immediate operation, for if the puncture be negative as to pus, it is non-conclusive, for no thorough exploration can be made through the skin — and a negative puncture thus made does not rule out pus absolutely. Transperitoneal puncture is even less warrantable.

The kidney is usually exposed through the lumbar route — and, when thus exposed, two forms of puncture may be made, — puncture by hollow needle, of good caliber, attached to a vacuum syringe, or apparatus, for the purpose

of withdrawing pus, or other fluid, – and puncture by solid needle, for the location of calculus. The object of the puncture, in either case, is to determine the warranty of further steps. While needle puncture is more conclusive than information secured by palpation alone, it gives naturally less positive and full knowledge than section of the kidney (nephrotomy – v. i.) – which, though, is a more radical measure.

Preparation – Position – Landmarks – Incision.—As for exposure of the kidney by an oblique lumbar incision.

Operation.—Having exposed and incised the perirenal fatty tissue, the kidney surface (the proper capsule) is exposed over as large an area as considered necessary by a blunt dissector and the finger. The kidney is then steadied by the fingers of the operator's left hand – while a needle, held between the right index and thumb (remembering the dimensions of the kidney), is thrust into the viscus – always being introduced in a straight line, and thrust from its point of entrance toward the hilum – being introduced, preferably, from the convex border – next in the sides – and, last, at the hilum (Fig. 4439). A needle may be thus introduced several times – always being withdrawn and re-entered before being made to travel in a new direction. The operation will be concluded according to the result of the puncture.

NEPHROTOMY

Description.—Incision of the kidney substance, including its capsule – and often including its calices and pelvis. Incision of the kidney pelvis (pyelotomy) and of the ureter (ureterotomy) will be separately considered. Complete axial division of the kidney is sometimes termed "bisection." Nephrotomy is performed for exploration; evacuation of urine, pus, and other fluids; exposure and removal of kidney stones; relief of tension in active or passive congestion in some cases of nephralgia, in the removal of tumors of the organ, and as a step in partial excisions.

Preparation – Position – Landmarks – Incision.—As for the exposure of the kidney by the lumbar incision, which is the best general route of approach – although nephrotomy may be practised in any operation in which the kidney may have been exposed.

Incision of the kidney is accomplished in several different technical ways. Those most generally used will be described. The preliminary steps are those connected with the bringing of the organ into the field – and have been amply covered under the exposure of the organ by the various routes – especially the lumbar route – so that in the explanation of the following technical procedures it will be supposed that the organ has been brought into the field.

As a preliminary to all sections of the kidney which are planned, or which are likely to end in deep or extensive incision, and especially in a combination of these two features, provision should be made for the control of bleeding from this vascular organ – either by digital or instrumental compression of the kidney pedicle in the wound. Limited incision may or may not require special vascular control – temporary gauze packing usually sufficing.

Limited Incision of the Kidney by Knife.—In many instances the position of the pathologic process will determine the site of incision, which is usually directly over it (Fig. 4440). While making the incision the kidney may be steadied by countertraction made by the clamp forceps which have grasped the perirenal tissues, as shown in the illustration. The incision may be placed and its depth determined by a preceding exploratory needle puncture (v. Fig. 4439) – or the section by knife may be the first and only procedure. Where no pathologic state especially indicates the site to be incised, a general

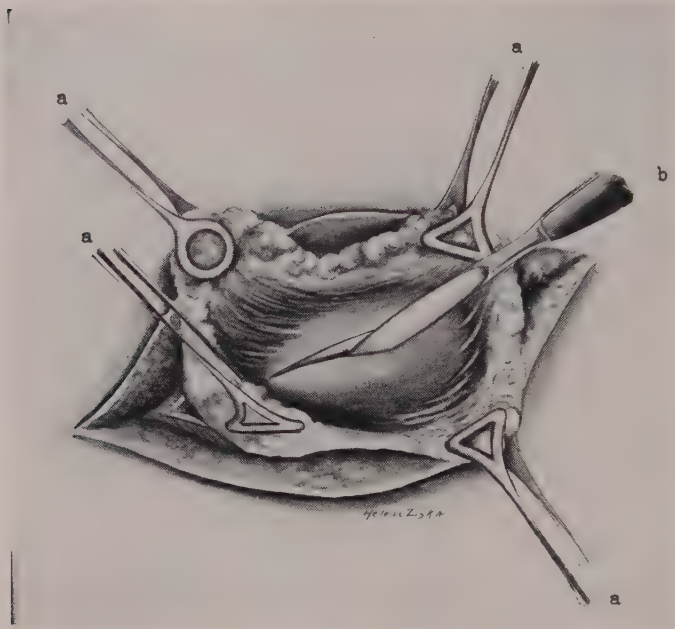


Fig. 4440.—Nephrotomy – I: – a, a, a, a, The kidney is brought well into the lumbar wound by traction upon its fatty areolar tissue; – b, knife incising the kidney substance.



Fig. 4441.—Line of Incision in Axial Nephrotomy; – Passing, longitudinally, just posterior to the prominent convex border of the kidney, through the least vascular area.

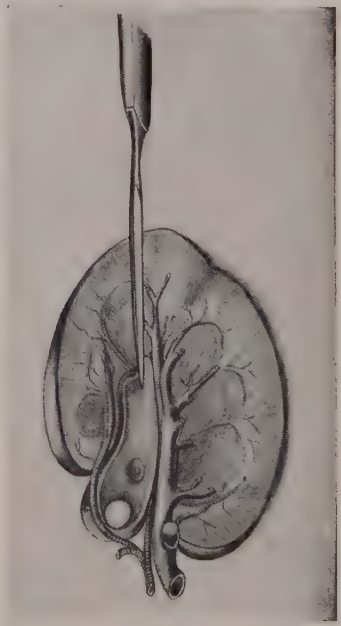


Fig. 4442.—Cross-section of the Axial Section of the Kidney from the Periphery into the Pelvis; – Through the least vascular route, just posterior to the free convex border. (The flat of the knife should parallel the cut surface.) (Modified from Kelly and Burnham.)

exploratory incision is usually made, in kidneys of average contour, parallel with the axis of the organ, along its convex border – but carefully placed just posteriorly to the prominent axial line of maximum convexity, to avoid cutting the larger vessels of the kidney – as stressed by Kelly and Burnham (Fig. 4441). Even after the incision has been properly placed, if the knife be not kept in the same straight line, that is, parallel, throughout its whole section, with and posterior to the axial line of the maximum posterior convexity of the kidney – but be allowed to swerve either toward the front or the back of the kidney, in its course to the pelvis of the kidney, a relatively large vessel is apt to be cut – as shown in Fig. 4442. In making straight incisions from the convexity of the kidney toward its hilum, they have also stressed, as being regions of least vascularity, the selection of either the junction of the upper and middle third, or of the middle and lower third, as the starting-points of incision

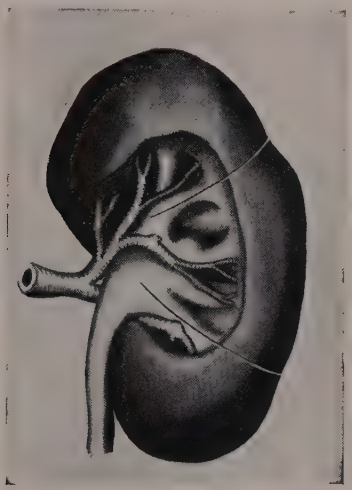


Fig. 4443.—Sites in Which Transverse Kidney Sections May be Made with Minimum Hemorrhage, in Average Cases; – The convex border of the kidney is divided into thirds, and lines drawn thence from the junction of the upper and middle, and middle and lower thirds, toward the pelvis of the kidney – which, in an approximate way, mark courses where large vascular trunks are less apt to be cut than elsewhere.

which pass, in a straight line, toward the pelvis of the kidney – as seen in Fig. 4443.

The depth to which incisions are made will be determined by the conditions for which they are made – and range from the simple division of the capsule, for nephralgia, to incisions through the kidney cortex, calices, and into the pelvis, for calculus – and, in length, from a mere stab incision to a complete bisection of the organ.

Bisection of the Kidney, by Knife, from Without Inward.—In cases where limited incision into the kidney substance will not suffice, it is sometimes necessary to lay the kidney widely open – splitting it from without, inward, axially, into two halves, flat-wise, or bisecting it, as sometimes termed – the division extending from the capsule into but not through the pelvis. The section is made just posterior to the line of maximum prominence of the posterior convexity – and extends from pole to pole, but not, usually, entirely through the extreme floor of the poles, nor to their extreme ends, enough kidney tissue generally being here left to serve as a hinge in opening and

shutting the split kidney. In bisecting the kidney the organ is, as a rule, held in the palm of the Surgeon's left hand – which is both convenient for the

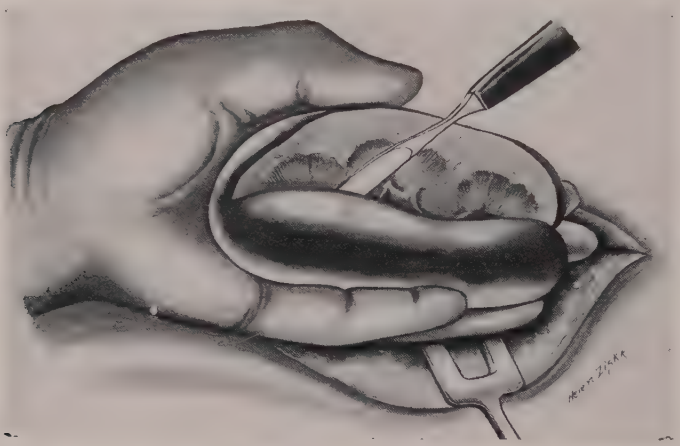


Fig. 4444.—Axial Nephrotomy; – The kidney, in this case, being held in the palm of the left hand the back of which has been sunk into the lumbar wound, while the approximated fingers compress the pedicle and control hemorrhage.

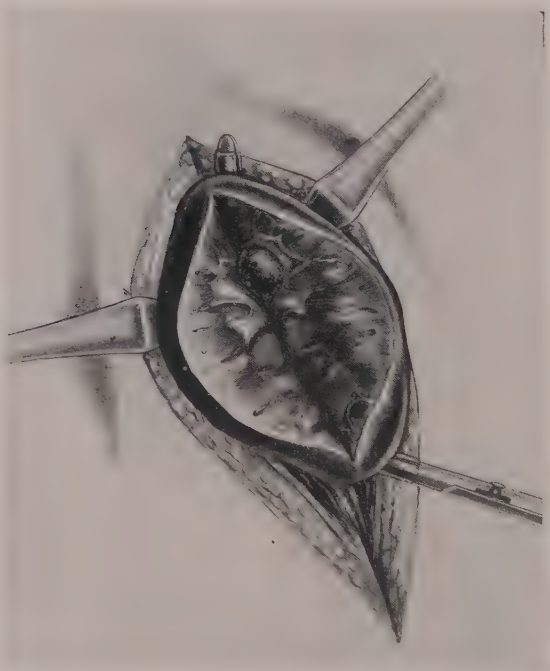


Fig. 4445.—Bisection of the Kidney with Clamp Control of the Pedicle; – A calculus is seen blocking one of the calices.

act of section, and, at the same time, enables him to control the vessels of the pedicle by the lateral approximation of the two fingers between which the pedicle passes. This technic is shown in Fig. 4444. Or the two poles of the

kidney may be supported upon warm, wet packs _ after the pedicle has been controlled by clamp pressure (Fig. 4445). Even when this latter method is adopted, the kidney must be steadied by the hands of an Assistant _ thus giving the Surgeon a greater range for manipulation. Care is exercised to cut exactly parallel with and just posterior to the plane of maximum convexity of the kidney border _ for the reasons mentioned above, under the simple incision.

In order to make the recognition of the pelvis clearer during the section Zondek suggested the partial inversion of the pelvis, at the hilum, by means of a finger-tip introduced under the kidney _ which, in addition to making the position of the pelvis plainer, also aids in mechanically separating the two arterial systems of the kidney prior to the act of making the section parallel with the axis. This maneuver is shown in Fig. 4446. It is desirable, in making

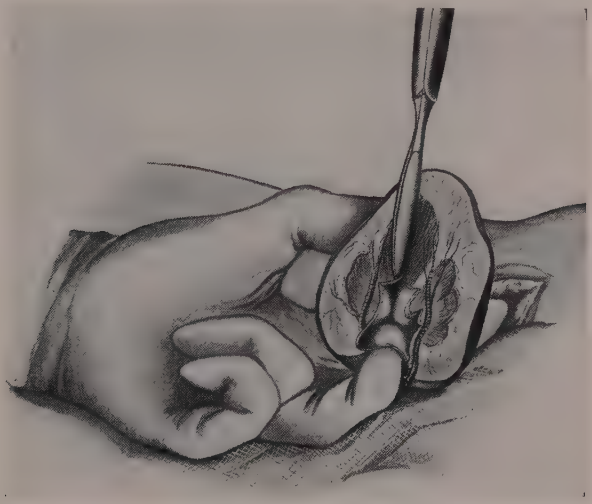


Fig. 4446.—Zondek's Method of Grasping and Incising the Kidney _ to expose the pelvis. (Modified from Kelly and Burnham.)

the section, to divide the minimum number of blood-vessels and uriniferous tubules.

Bisection of the Kidney by Bistoury from Within Outward.—This method of splitting, or laying open the kidney, is usually the one of choice _ and for the reason that in cutting from within outward fewer vessels are divided, the blade of the knife pushing some of them aside in its progress from the pelvis toward the convexity _ as compared with cutting inward from without. The comparison has been made with the greater ease experienced in carrying a stick from the center of a bush outward, parting the limbs and twigs in its exit _ and the greater difficulty in carrying it from without, inward, encountering and breaking many blocking twigs on the way.

It is easier to bisect the kidney if the ureter be first injected with saline solution through a renal catheter. Zondek's technic, just described, also aids. However, none of these accessory technics are absolutely necessary. A straight, limited incision is made parallel with and about 8 mm. ($\frac{1}{3}$ inch) (or a shorter distance according to some) posterior to the line of maximum convexity of the kidney, with an ordinary knife. This incision passes directly through kidney substance, into the lower calices, and thence into the pelvis.

Or the initial incision may be made into the calices – and a relatively sharp-pointed hemostat be pushed thence on into the pelvis, and its blades then

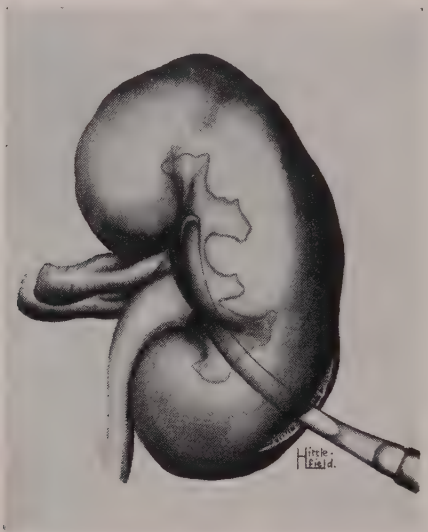


Fig. 4447.—Axial Nephrotomy, by Means of a Curved, Probe-pointed Bistoury Introduced Into the Pelvis of the Kidney Through an Ordinary Incision, – and is then made to cut its way from within outward – making its exit along the section shown in Fig. 4448.

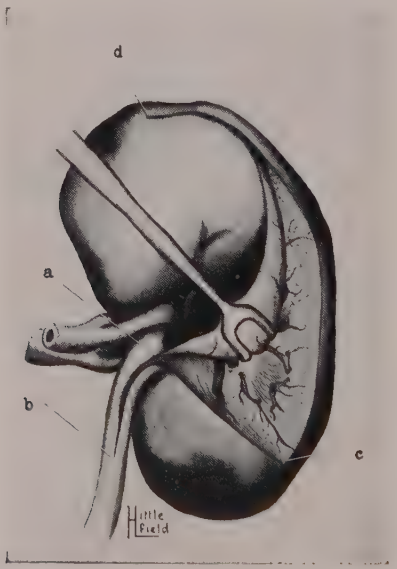


Fig. 4448.—Nephrotomy and Pyelotomy; – The kidney has been cut, by silver-wire section, first obliquely from pelvis to convex border, a to c, and then axially, c to d – after which the pelvis and beginning of the ureter may be incised by knife or scissors, b,

opened – after which, along this route, a curved probe-pointed bistoury is carried through the kidney into the pelvis – and the kidney bisected by cutting toward the convexity from within outward (Fig. 4447).

Combined Incision of the Kidney, Pelvis, and Beginning of the Ureter.—The most bloodless manner of accomplishing this, as considered by Kelly and Burnham, is by a combination of incisions through least vascular zones—the order of making which will depend upon the exploratory incision first made, and the need of extending this original incision into new regions. The section may, as in Fig. 4448, begin as an oblique section, from pelvis to just posterior to the convex border of the kidney, along the least vascular line at the junction with the middle and lower thirds of the kidney (v. Fig. 4442). This section may be made by knife or, better, by silver wire, conducted through a limited opening in the pelvis (v. Fig. 4454). The axial section is then made—and, finally, the pelvis is incised by knife or by scissors. Or, if the extensiveness of the incision have been anticipated, the pyelotomy incision may, probably better be first made in the pelvis, and extended, thence, obliquely to the convex border, and along it (that is, posterior to it) toward the opposite pole. The

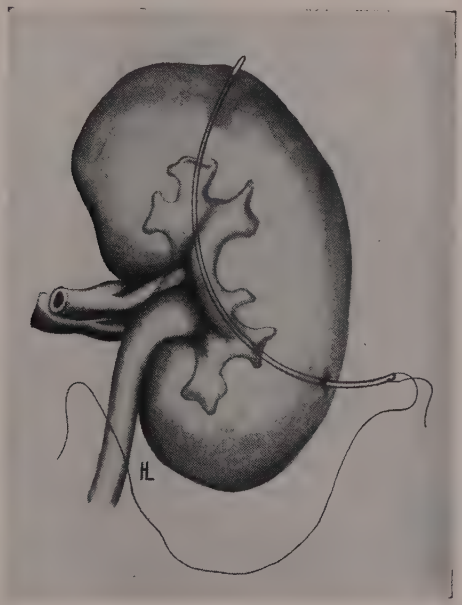


Fig. 4449.—Axial Nephrotomy by Silver-wire Section,—technic of Cullen and Derge.

suturing of such a section as this will be described under Nephrorrhaphy (p. 346).

Section of the Kidney by Silver Wire.—The method of substituting silver wire for the knife, as a means of performing nephrotomy, has been successfully worked out by Cullen and Derge—who give this method of dividing kidney substance the preference. Number 3 silver wire, pliable and of low tensile strength, is used, with which, they claim, it is almost impossible to tear any of the larger vessels of the kidney if ordinary care be used. Immediate and postoperative hemorrhage are minimized. The kidney is steadied in the hands of an Assistant. The silver wire is carried into position upon a large, curved, special needle, with blunt point. The capsule of the kidney, at the points of entrance and exit of the needle, is nicked with a knife. The wire is conducted into position, twisted upon the carrier needle—after which the section of the kidney substance is accomplished by a gentle, even, back-and-

forth, see-saw movement of the wire, the wire cutting from within outward. The greatest resistance experienced is in dividing the walls of the calices and pyramids and the capsule. The wire tends to cut its way between the vessels rather than through them.

In making an axial section, posteriorly to the lateral convexity of the kidney, two limited incisions are made with the point of a knife through the capsule. The blunt end of the needle is made to enter one incision _ pass downward through a calix into the pelvis _ traverse the pelvis and make its exit through a calix toward the opposite pole _ and thence penetrate the kidney substance to the surface _ where the bulge of the needle should be cut down upon by knife for its exit (Fig. 4449). The entire axial section need not be made in one sweep, but may be made in sections. The perforation should be made upon the ventral aspect of the papillæ, so as not to tear the papillary parts of the posterior pyramids, thereby damaging the large collecting tubes of the medulla. Section nearly to the poles sufficiently exposes the calices of the poles to enable these to be examined, without the actual complete division of the poles, which should be avoided if possible, epecially the com-

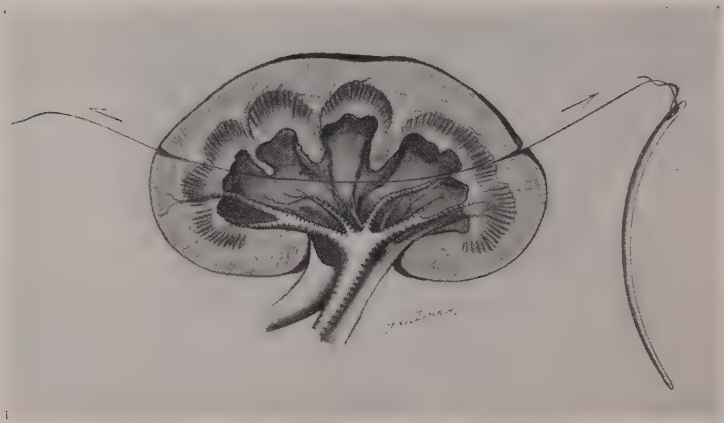


Fig. 4450.—Axial Nephrotomy by Silver-wire Section, _ seen in longitudinal section. The wire is *in situ*, following the introduction of the conducting blunt needle.

plete division of the upper pole, with its probable damage to the dorsal vein. A sectional view of the wire in position for axial section is seen in Fig. 4450.

Instead of beginning the silver-wire axial section of the kidney from the convexity of the organ, one may begin by limitedly incising the pelvis _ and, through this opening carry the silver wire, armed with a straight, blunt needle, at either end _ the needles making their exits through nicked incisions posterior to the convexity of the kidney, drawing the silver wire after them (Fig. 4451) after which the section is made in the usual manner. This technic is especially desirable where double pelves happen to exist.

A third method of sectioning the kidney by the silver-wire technic _ and apparently the method of choice of its originators, Cullen and Derge _ is the following: _ The kidney is delivered well into the wound, sufficiently far to give access to its pelvis. A limited incision is made in the pelvis, and through this the blunt needle, armed with wire, is carried into an adjacent calix _ thence into the kidney parenchyma _ and on out through a short incision in the capsule posterior to the convexity (Fig. 4452, a). The sectional view of the parts traversed by this excursion of the needle, and on-coming wire, is shown in

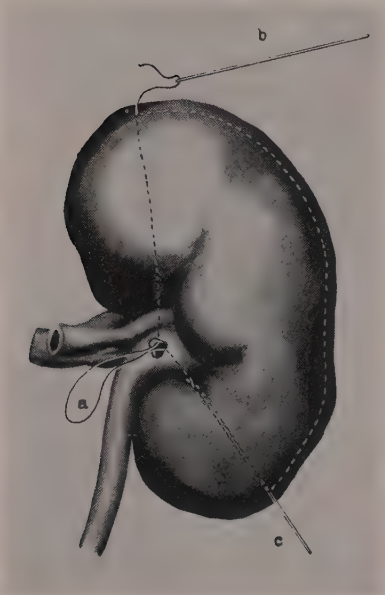


Fig. 4451.—Axial Nephrotomy by Silver Wire Conducted Through the Kidney Substance from Without by Incision in the Pelvis, by the Cullen and Derge technic.

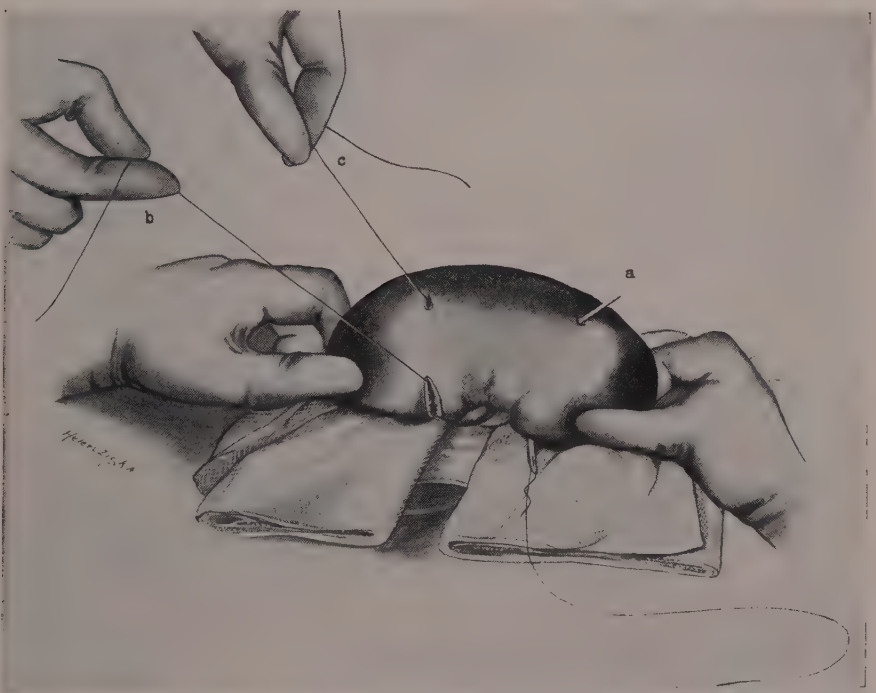


Fig. 4452.—Transverse Nephrotomy by Silver Wire Section. Cullen and Derge's technic: a, Blunt needle conducting silver wire from parapelvic region to near the convex border; b, making a corresponding section of the kidney near the opposite pole by back-and-forth traction upon the wire. (Two stages of a single operation are here represented for convenience.)

Fig. 4453. When the wire is drawn through, it is manipulated, in back-and-forth see-sawing, as seen in Fig. 4454, **b, c** _ and when this section is made

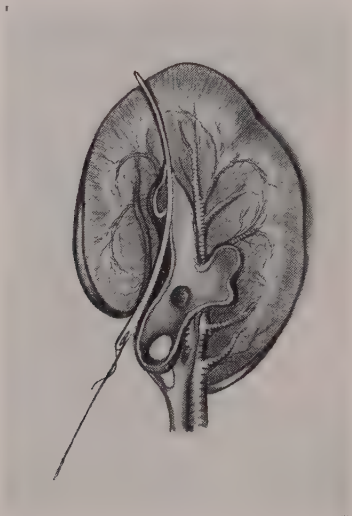


Fig. 4453.—Transverse Sectional View of Line of Conducting Needle in Making Lateral Section of Kidney by Silver Wire _ the needle passing through relatively non-vascular structure. (Redrawn from Cullen and Derge.)

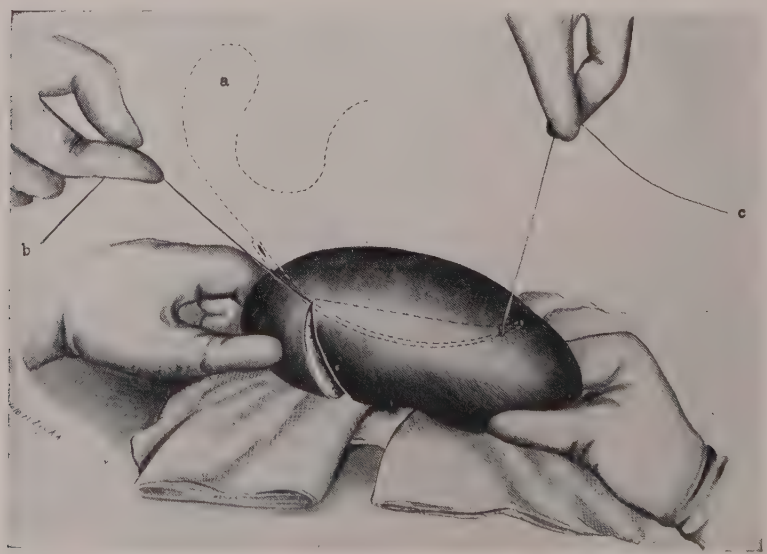


Fig. 4454.—Combined Transverse and Axial Nephrotomy by Silver-wire Section, _ Cullen and Derge's technic; _ Having completed the half-transverse section, as shown in Fig. 4452, the curved blunt needle, **a**, carries the silver wire, **b**, through the substance of the kidney, as indicated by the double dotted line _ after which the section is made by back-and-forth traction between **c** and **b**. (Two stages of a single operation are here represented for convenience.)

the wire is similarly conducted, now axially, just posteriorly to the convexity (Fig. 4454, **a**) _ after which the same see-sawing (Fig. 4454, **b, c**) divides

the kidney axially. If this oblique and axial incision, producing a triangular flap of one lateral aspect of the kidney, do not give sufficient exposure, the second oblique section may be made (as suggested in Fig. 4448 already quoted), resulting in a quadrangular flap.

The final closure of all nephrotomy wounds will be considered under Nephrorrhaphy (v. p. 346) _ and the drainage of those left open, under Kidney Drainage (v. p. 351).

Comment.—Where hemorrhage is severe on cutting into the kidney, it may be controlled by compressing the pedicle (which should have been demonstrated in advance) between the fingers or special clamps _ or by gauze packing. Hemorrhage from a healthy kidney is often enormous _ while it is generally much less from a diseased one.

In unhealthy or suspicious cases drainage is established down to the kidney _ or, if indicated, into not only the kidney itself, but even into the pelvis _ with gauze or tube, preferably gauze packed into the pelvis and calices.

Transverse, or Oblique, Nephrotomy.—Strictly transverse incision of the kidney is rarely performed, but oblique incisions which radiate toward the hilum are, as mentioned, sometimes employed, especially in connection with para-axial incisions, and incision of the pelvis. Of the oblique incisions, the safest to make is the one at the junction of the middle and lower thirds _ as there is here less danger of cutting a considerable branch of the renal artery (v. Fig. 4443). In incising transversely, or obliquely, it is to be remembered that the vessels run, in the main, between the calices and pyramids, and through the center of each pyramid, and the incisions should be planned accordingly _ as the columns of Bertin and the pyramids are usually to be recognized upon the surface of the kidney.

PYELOTOMY

Description.—Pyelotomy, or renal pelviotomy, consists in the incision of the pelvis of the kidney _ and is generally resorted to for the removal of calculus of the pelvis, or of the kidney, or for exploration _ as well as constituting a step in some of the operations to be mentioned in connection with plastic procedures upon the pelves and ureters. The step may be undertaken as an incident in the course of some other operation begun for another purpose _ or it may be deliberately planned as the specific operation. The approach is usually by the lumbar route.

Preparation _ Position _ Landmarks _ Incision.—As for exposure of the kidney by the lumbar route.

Operation.—There is no special feature about the incision of the pelvis which has not been already covered under Simple Nephrotomy (p. 333), and Nephrotomy for Calculus (p. 353), _ where, incidentally, the division of the pelvis of the kidney has been both mentioned and pictured. The most usual purpose for which pyelotomy is performed is for calculus _ and, as mentioned under Comments, in connection with nephrotomy for calculus, it is stated that, in the estimate of some Surgeons, calculus of the kidney should by preference be removed, when possible, through an incision made in the pelvis, rather than by one made through the substance of the kidney.

Having incised and freed the fatty capsule and exposed the kidney by blunt dissection, the organ is brought forward by grasping its loose areolar tissue capsule with several clamps, until drawn as far into the wound as possible. The pelvis itself may often be brought conveniently forward, after the kidney is delivered into the wound, by passing a finger behind it and pressing it forward (that is, toward the Surgeon _ Fig. 4455). An axial incision is made through the posterior wall of the pelvis, following the curve of the structure.

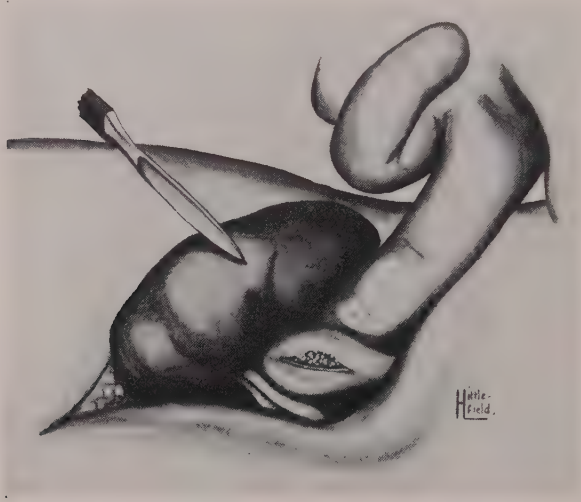


Fig. 4455.—Pyelotomy for Calculus or for Exploration, – Finger, inserted beneath the ureter pressing the pelvis and beginning of the ureter prominently forward. A calculus is here seen in the incised ureter. (The knife here shown has simply been lifted from the incised pelvis – and is not cutting the kidney.)



Fig. 4456.—Pyelotomy – for the Extraction of a Renal Calculus.

Scarcely any hemorrhage follows incision of the pelvis, as a rule – in contradistinction to the rather free hemorrhage which nearly always follows, at first, incision of the kidney parenchyma. Two temporary silk traction-sutures

may be placed in the lips of the incision _ or they may be grasped by special delicate, non-traumatizing forceps _ and, with these, the margins of the small wound may be held open during manipulations.

It is well to steady the kidney with special holding forceps (Fig. 4456).

Into the opening thus made, and held apart by the tractors, a special sound or forceps, or the finger is introduced, and examination made for the object sought _ both in the calices above and in the ureter below. If it be necessary to secure additional room, the original cut in the pelvis must be enlarged _ and this is done in the special manner already indicated in treating of nephrotomy _ in a straight line obliquely downward and toward the convexity of the organ, along the site corresponding with the junction of the middle and lower thirds of the organ, on its posterior surface, to a point posterior to the convexity of the kidney _ and from this point an axial incision may be extended toward the upper pole. If the incision from the pelvis were enlarged directly toward the upper pole of the organ, the rather constant and large

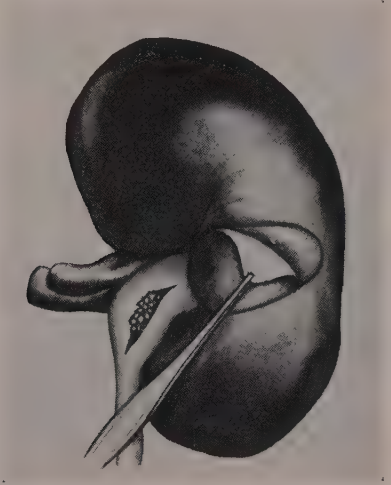


Fig. 4457.—Payr's Method of Reinforcing the Area of Wound in the Pelvis of the Kidney _ I; _ A portion of the adjacent kidney capsule is being raised as a hinged flap to cover and strengthen, in this case, the site of an incision for the removal of a calculus.

posterior branch of the renal artery would be apt to be cut _ the general vascular arrangement having been already illustrated in Fig. 4443. Such a combined section as this constitutes nephropyelotomy or pyelonephrotomy.

In cases without kidney, or ureteral infection, or ureteral blockage, the wound in the pelvis ordinarily heals well. When the object of the operation has been accomplished (and this should be verified by thorough examination after it is supposed to be), the wound in the pelvis, in clean cases, is closed by layer suturing, in the manner to be described under Nephrorrhaphy, p. 346. For fear of leakage temporary drainage may be established down to the sutured pelvis. In infected cases free drainage of the pelvis is established (v. Nephrotomy for Drainage of the Kidney, p. 351). Finally, the kidney is returned to its normal site _ and the lumbar wound closed, up to the site of the drain, if one be employed.

Comments.—While incision into the pelvis is followed by little or no bleeding, and admits of probing the ureter, it gives no access to the kidney

parenchyma _ and but imperfect access to the calices _ unless extensions be made to the original incision.

While it is stated by some that urinary fistula is more apt to follow incision of the pelvis than when the kidney proper is incised, Kelly and Burnham state that a limited, clean incision of the pelvis could be safely left to nature to close _ and that not even a drop of urine may escape, even though no suturing be done.

That such ideal results should follow, however, one should see that the ureter is free of obstruction _ and that there is none or but very little kidney infection.

The calyx, or the site of the lodged stone, may have to be dilated with special forceps before the stone can be loosened and removed.

Sometimes the site of the sutured incision made into the pelvis of the kidney, especially where possible leakage is feared, be reinforced by a small flap of

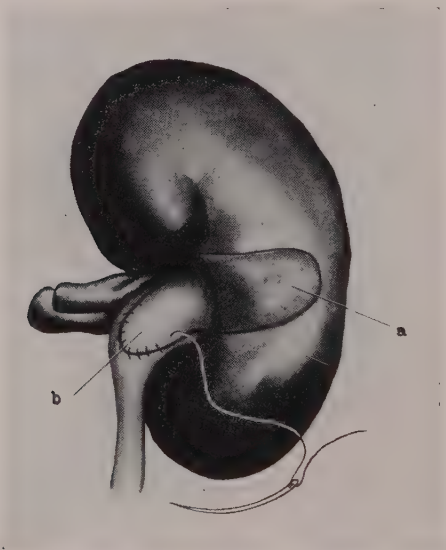


Fig. 4458.—The Same _ II; _ Having sutured the incision through which the calculus has been removed, the site is reinforced by suturing the reverted capsular flap over the wound in the pelvis.

kidney capsule, raised from the kidney in the immediate vicinity (Fig. 4457) _ and hinged backward and sutured over the already sutured pyelotomy wound (Fig. 4458).

NEPHRORRHAPHY AND PYELORRHAPHY

Description.—Nephrorrhaphy, or suturing of the kidney substance _ and pyelorrhaphy, or suturing of the kidney pelvis _ are here described in connection with wounds of the kidney and of the pelvis which have been made either in the course of surgical operation or by traumatism. In the case of operative wounds the kidney will have been exposed by one of the technical procedures. In the case of traumatic wounds the kidney will be exposed either by enlarging the traumatizing wound or by one of the usual procedures of exposure. Most operations involving nephrotomy and pyelotomy also involve nephrorrhaphy and pyelorrhaphy _ unless drainage be instituted. Nephropexy involves a special form of kidney suturing.

Nephrorrhaphy.—The best type of kidney suture, involving any depth of kidney tissue, is the mattress-stitch – as by its nature its support and

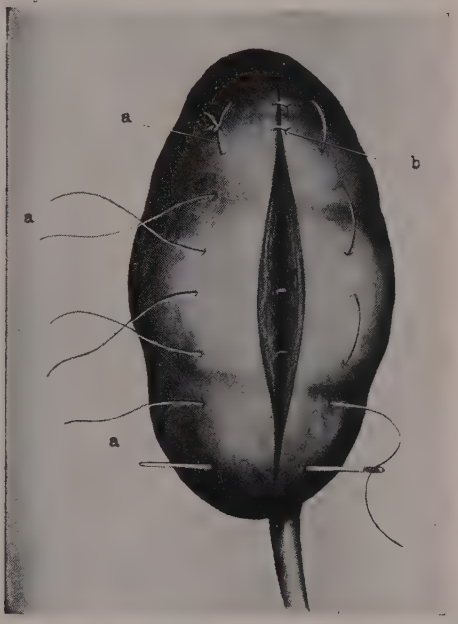


Fig. 4459.—Nephrorrhaphy: – a, a, Deep mattress-sutures placed with blunt needle; – b, b, superficial marginal sutures.

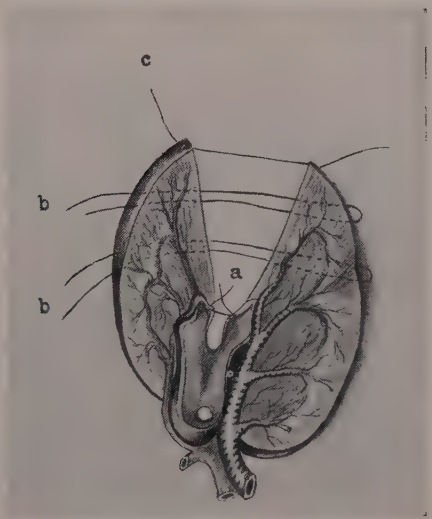


Fig. 4460.—Placing the Sutures Following Axial Bisection of the Kidney: – a, Buried, non-penetrating fine catgut sutures of the pelvis; – b, b, one or two rows of mattress-sutures through the deeper parts of the kidney; – c, one of the superficial marginal sutures of the capsule. (Modified from Kelly and Burnham.)

counterpull are both against the outer aspect of the resistant, fibrous capsule (Fig. 4459, a, a). Where the section of the kidney substance is not very deep

a single tier of the mattress-sutures will suffice, as shown in the above illustration. Where, on the other hand, a kidney has been deeply incised, or bisected, two tiers of these mattress-stitches are often used, one above the other – as shown, in sectional view, in Fig. 4460, **b, b**. These stitches are shown in the act of being tied, and completely tied, in Fig. 4461, **c, c.** As applied to a kidney laceration from traumatism they are seen in Fig. 4462, **a, a.**

The best type of suture for the capsule of the kidney, and the superficial part of underlying parenchyma, is the continuous stitch. Interrupted sutures may be employed if the incision to be sutured is not long. The continuous suture is seen in most of the accompanying pictures – and the interrupted, in conjunction with the mattress-suture, in Figs. 4461 and 4462.

All kidney suturing should be made with catgut, – finer for the capsule and superficial parenchyma, and somewhat heavier, though still of small size

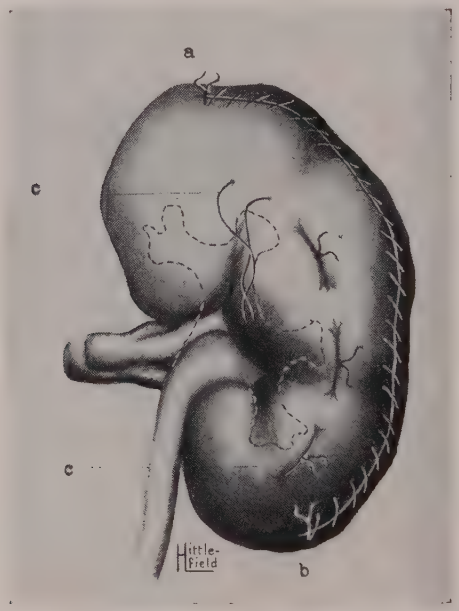


Fig. 4461.—Nephrorrhaphy by Means of Both Deep, Transfixing Mattress-sutures, Passed Just Above the Calices, and Superficial, Continuous Suture of the Margins. The uppermost mattress-suture is ready to be tied. (The elements of the continuous suture are too close together.)

(but not fine enough to divide tissue), for the deeper mattress-sutures. Whether the catgut be plain or chromic will depend upon the judgment of the Surgeon – the Author would prefer fine, plain, for the capsule, and intermediate, chromic for the deeper stitches. The suturing is most conveniently and expeditiously placed with a Reverdin needle, but an ordinary type of surgical needle may be used, held in a needle-holder – with the modification, whether Reverdin or surgical needle be used, that its point should be blunt, in the case of penetrating the deeper, more friable, and more vascular parts of the kidney. A sharp needle is preferable where the more superficial, more resistant capsule is penetrated.

The simple, interrupted stitch tends to cut through the kidney substance when used as a deeper suture. Its use as such, in the deeper parts in conjunction with superficial continuous suturing of the margins, is seen in Fig. 4463.

Sometimes a kidney wound is sutured throughout, though probably not

so wisely, by simple interrupted sutures – the stitches being, in alternation, superficial and deep.



Fig. 4462.—Suturing of Lacerated Kidney: – a, a, Deep mattress-sutures; – b, b, superficial interrupted sutures.

In the case of suturing a bisected kidney, or one deeply incised, with two tiers of mattress-sutures (v. Fig. 4460), the lower tier is placed at about the

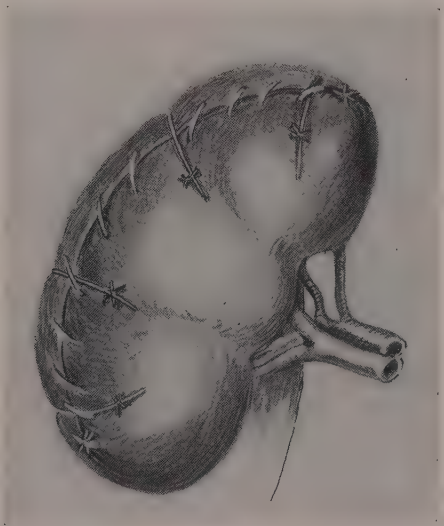


Fig. 4463.—Nephrorrhaphy of a Bisected Kidney – by combined deep, approximating mattress-sutures and superficial marginal sutures.

level of the papillæ, in the interpapillary regions – and the upper tier, through the cortical substance of the kidney, about opposite the bases of the pyramids.

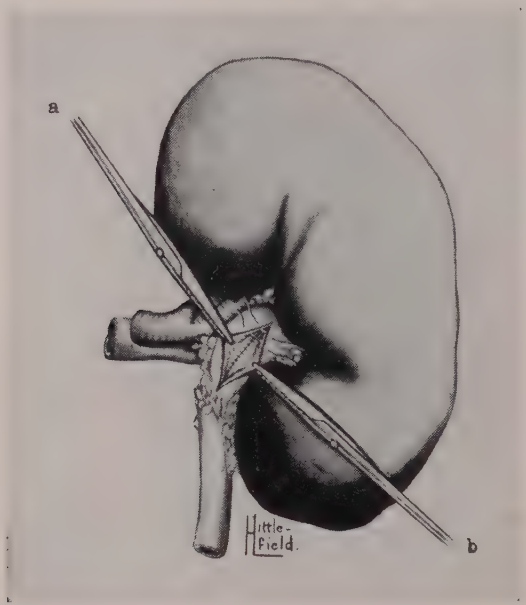


Fig. 4464.—Pyelorrhaphy; _ The mucosa of the pelvic wound is seen sutured with fine catgut stitches followed by an overlying tier of sutures of the fibrous and fascial coats.

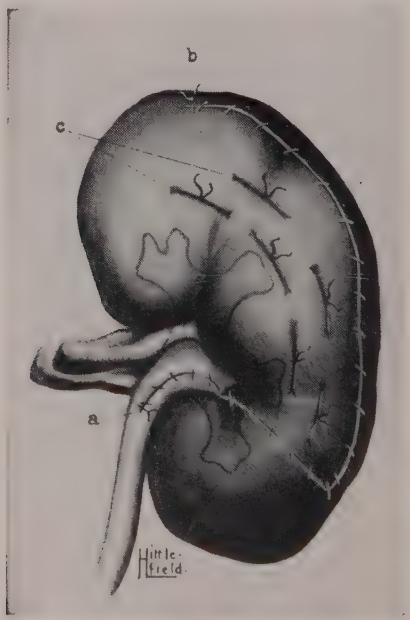


Fig. 4465.—Nephrorrhaphy and Pyelorrhaphy; _ following combined axial and transverse nephrotomy and pyelotomy, for extensive exposure of the kidney cavity and ureter.

In placing the mattress-sutures with a blunt-pointed needle either a long needle of the Keith type, held in the fingers, or an ordinary, long needle, held

in a holder, may be used _ unless, as already expressed, the preferable Reverdin needle be not at hand.

In suturing a kidney wound which has passed through the kidney substance and into the pelvis, the opening into the pelvis is usually sutured, and, if so, this must be done first while the site is accessible. These sutures are placed between the calices and are carried only through the submucous tissues _ not penetrating the mucosa _ v. Fig. 4460, **a**. If it be difficult to place, it may be omitted.

Pyelorrhaphy.—Following the operation of pyelotomy, or following wounds of the pelvis, the pelvis opening should, preferably, be closed by suture _ but if no impediment to the urinary outflow exists, it tends to heal even without suturing. To complete the operation technically, however, suturing should be performed. Two methods of accomplishing this are in use. In the double layers of suture, with fine chromic catgut, the first layer of continuous or interrupted sutures includes the margins of the mucosa only _ and the second layer, the fibrous and overlying fascial coverings. In the single layer method the mucosa is not included, the suture taking up only the fibrous coat and fascial covering of the pelvis. It is the suturing of the fibrous and fascial coverings which is the most important. The technic is shown in Fig. 4464.

The suturing of a bisecting incision of the kidney, to which has been added an oblique incision to the pelvis, along the junction of the middle and lower thirds of the kidney, and the laying open of the pelvis of the organ, is seen in Fig. 4465. Two tiers of deep mattress-sutures through the substance of the kidney are here also seen.

NEPHROTOMY FOR RENAL ABSCESS

Description.—In circumscribed suppurative nephritis, or abscess of the kidney, under consideration, the condition is that of one or more abscesses, of definite form, and of considerable size _ in contradistinction to diffuse renal suppuration or pyonephrosis (which will be dealt with in connection with nephrostomy, p. 357). The objects of the operations are evacuation of pus and establishment of drainage.

Preparation _ Position _ Landmarks _ Incision.—As for the exposure of the kidney by the lumbar route.

Operation.—Having exposed the kidney in the usual manner, the organ is delivered into the wound, as far as may be necessary for the subsequent manipulations, and steadied by the fingers, or in the hold of special forceps. If the site of abscess be evident upon exposure of the surface of the kidney _ or through manipulation _ or by reasonable needle exploration, without endangering the sound part of the kidney _ the incision into the kidney will generally be so placed as to reach it by the safest route, and usually the most direct route. Where no guidance to the abscess is given, an incision, at first limited, is made (after digital or instrumental control of the kidney pedicle) parallel with and about 8 mm. ($\frac{1}{3}$ inch) posterior to the midline of the maximum convexity of the organ, and within the lower half, or lower third of the kidney. This incision should be made with a sharp-pointed knife, and pass from the surface into the calices of the lower part of the organ. Into the incision thus made, and while the kidney is steadied, closed dressing or sinus forceps may be introduced, and then opened, for the purpose of stretching the wound by the blunt backs of their blades (Fig. 4466). After this has been done a finger should be introduced into the wound, and the structures examined (Fig. 4467). If it be necessary to extend the incision into the pelvis, this is more readily accomplished after distending the pelvis with saline solution.

introduced by carrying the needle of a syringe into the pelvis, while the clamping of the pedicle prevents its outflow. If it be found necessary to extend the

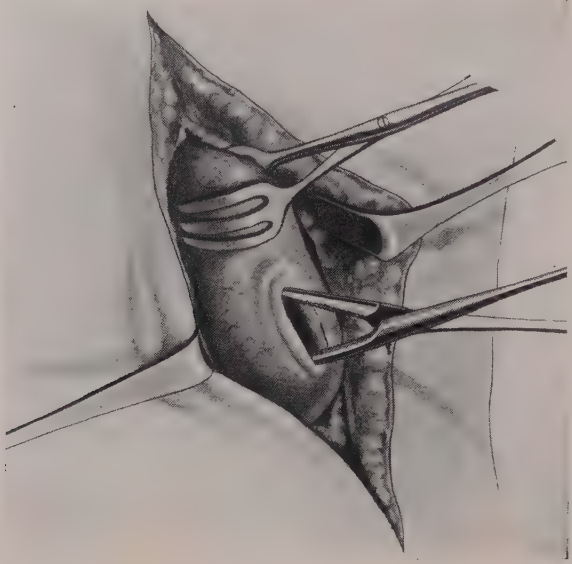


Fig. 4466.—Nephrotomy for Renal Abscess – I; – The kidney has been exposed by the lumbar route, brought into the lumbar wound and steadied, while the limited incision, made just posterior to the midline of the convexity of the organ, and in the lower third, is being enlarged by the separated blades of forceps.

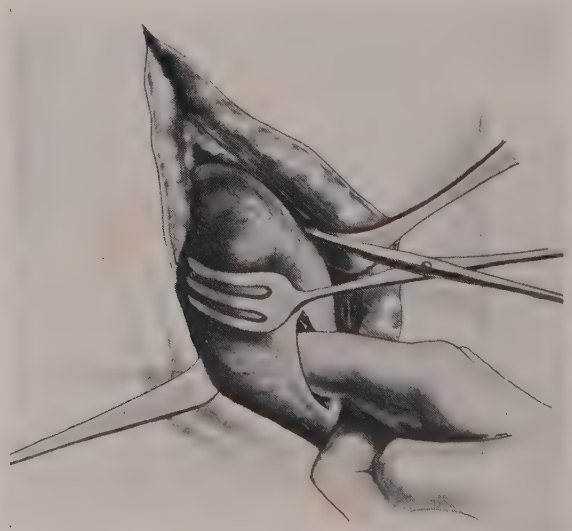


Fig. 4467.—Nephrotomy for Renal Abscess – II; – Examination of the interior of the kidney by finger

incision made by a sharp-pointed knife, this is best done by a probe-pointed knife (v. Fig. 4447), manipulated from within outward. Before the operation may be considered concluded a careful examination should be made, to see that

no adjacent abscess cavity is left unopened — and that the pelvis of the kidney and ureter are free of involvement.

Finally, in closing the operation, one of two technics may be adopted: — If no obstruction or condition exists to the favorable progress of the local state, a rubber drain is carried into the kidney wound, the lips of which, including the capsula propria, are sutured up to the exit of the drain (Fig. 4468). If, on the other hand, the operation have been performed for a calculous condition, which has not been fully and satisfactorily relieved at the time of the primary procedure, then the margins of the kidney wound, including the proper kidney capsule, are anchored, by chromic catgut sutures, of the mattress type, into the margins of the cut lumbar muscles — and the rubber tube or gauze drain conducted thence outward — the technic of drainage then being practically

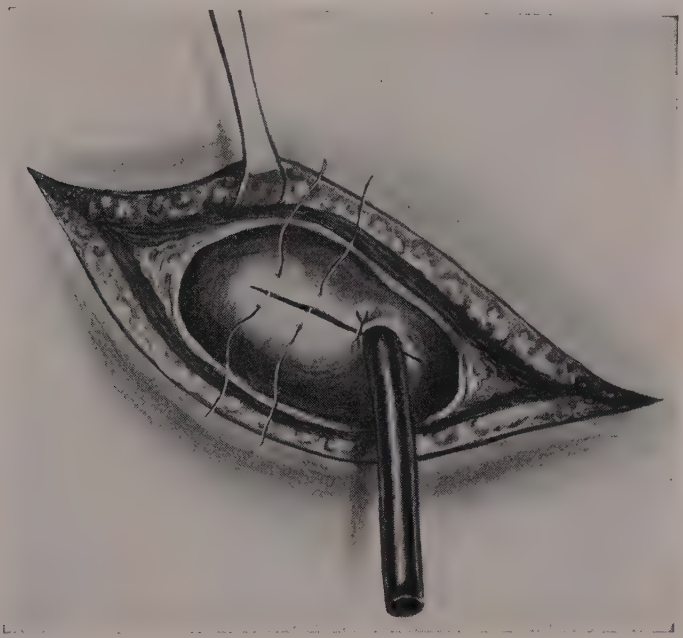


Fig. 4468.—Nephrotomy and Nephrostomy for Renal Abscess — III; — Rubber tube drainage of the evacuated pus-cavity. The capsula propria is sutured up to the exit of the drain from the kidney.

the same as in nephrostomy (v. Figs. 4470 and 4471) — the lumbar wound being closed up to the drain.

NEPHROTOMY, OR KIDNEY SECTION, FOR RENAL CALCULUS

Description.—The operation consists in incising the kidney for the purpose of removing a stone of the kidney — either from the kidney substance proper — or from the pelvis of the kidney — or from the beginning of the ureter. The compound term, "nephrolithotomy," so often employed, is, of course, incorrect, as it implies the cutting of the kidney stone itself — being an application, to kidney surgery, of the faulty term of "lithotomy," rather than "cystotomy for calculus."

A stone may be removed from the kidney in the course of any operation by any route of exposure, during which it may be discovered — and the technical act of removal is practically the same in all — but the classical operation

for the removal of stone of the kidney is usually by the lumbar route of exposure (v. p. 312).

Renal calculus may be accidentally discovered in the course of an operation, or, deliberately, by *x*-raying – in both instances, prior to its having caused local disturbances within the kidney, including suppuration, and more or less disintegration of kidney substance, as well as recognizable symptoms – in which case operation for its removal may be a clean procedure, without drainage or with but temporary drainage. On the other hand, the presence of calculus may have produced phenomena leading up to its suspicion or detection – and, at the time of operation, all the phenomena of suppuration with more or less destruction of the kidney may have occurred – conditions generally necessitating more considerable procedures – and always calling for drainage.

Preparation – Position – Landmarks – Incision.—As for exposure of the kidney by the lumbar route.

Operation—The procedure will differ materially according to the presence or absence of infection in conjunction with the stone: – (*a*) Operation for Renal Calculus in the Absence of Infection: – The kidney, freed of its perirenal areolar tissue, is delivered sufficiently into the wound for manipulative examination. Palpation is the first and simplest means of determining the presence of stone. In some instances the presence and position of the stone, or one of the stones, may be readily determined at once – which will also determine the position and nature of the incision to be made for its removal. In other instances, examination of the interior of the kidney by puncture with a solid needle, in various directions (v. p. 332), may be necessary. In still other cases the calculus is not discovered until the kidney is incised, and the finger introduced. A kidney is sometimes bisected before a small, deeply embedded calculus is discovered. Instead of examining for calculus by puncture of the kidney proper by solid needle, or by incision, the pelvis of the kidney may be subjected to the same steps – namely, solid needle puncture and incision – and, through this method of approach, the pelvis itself, the kidney distally, and the ureter proximally may be examined by probe. Such an incision of the pelvis as has been described and pictured in conjunction with nephrotomy by silver wire (v. p. 339) would suffice as an entry for exploration.

The stone may be eventually located within the parenchyma of the kidney, nearer the capsule than the pelvis, as well as more conveniently placed for approach through the capsule – and, in such a case, there is no reasonable question but that incision should be made by knife through the capsule and intervening parenchyma by a straight incision and by the shortest route, and the stone removed by forceps. On the other hand, the stone may be within the pelvis of the kidney, in a calix, or so placed as to present two routes of removal open to individual judgment and choice – and in such cases the incision may either be made through the capsule and parenchyma or through the pelvis. But, all in all, it is rather better to incise through capsule and parenchyma than through the pelvis – for experience has shown that healing is prompter, and troublesome urinary fistula less apt to occur if the stone be removed through the parenchyma of the organ. A calculus being removed from the calix of the kidney through an incision made in the capsule and parenchyma of the organ is seen in Fig. 4469. The incision here shown may be unnecessarily long – although the kidney is sometimes completely bisected in exposing stones. A small incision may often be sufficiently enlarged by the introduction of the blades of forceps closed, and then opened.

Following the removal of a renal calculus, even in uninfected cases, temporary drainage is safer – usually by a strip of gauze packed into the kidney wound and brought out of the lumbar wound – the rest of the kidney wound, as

well as the lumbar wound, being closed by suture up to the exit of the drain. Catgut is used in suturing the kidney substance _ chromic catgut for the buried sutures of the lumbar wound _ and silkworm for the skin sutures.

(*b*) Operation for Renal Calculus in the Presence of Infection: _ An incipient degree of infection, or marked pyonephrosis, with little or considerable disintegration of the kidney structure, may be present. Sometimes the distention of the organ, through hydronephrosis or pyonephrosis, is so great that it cannot be delivered into the abdominal wound, especially if the costo-iliac space be narrow. In these cases it is necessary, and in all cases it is desirable, to first evacuate the fluid by suction drainage _ puncturing the kidney substance with the drain and carrying it into the cavity _ before undertaking to deliver the kidney into the wound, and especially beiore incising it. In this way the size of the organ is reduced and its delivery made easier _ and the otherwise gush of pus into the general wound in incising a distended pus kidney is avoided.

When the removable portion of pus has been drawn away by suction drainage, and the kidney incised, the finger should be introduced into the

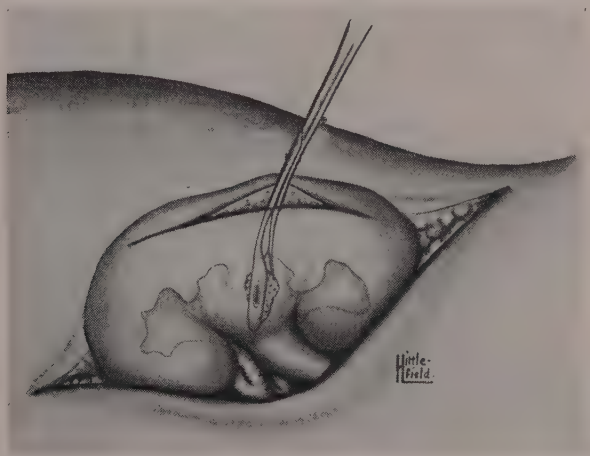


Fig. 4469.—Nephropyelotomy for Calculus; _ The forceps are seen grasping a stone in the pelvis of the kidney through an axial incision in the convex border of the kidney.

opening and a systematic examination be made for the stone or stones _ which may be very much harder to find, owing to the disorganized condition of the kidney, than under more nearly normal conditions. Indeed, sometimes the cavity may be so deep, or the kidney so honey-combed, or the calculus so far down in the beginning of the ureter that it may be exceedingly difficult, or altogether impossible, to locate the stone. If, however, before abandoning the search, a calculus be detected deeply impacted within a calix, and not readily removable by finger or forceps through the original opening in the kidney, it is sometimes wiser policy, rather than make fruitless and damaging efforts to remove it through the incision already made, to steady it by pressure against it by a finger within the kidney, while a second incision is made directly over it, through the immediately overlying kidney wall, and remove it through this secondary kidney wound which may be subsequently sutured, to lessen complications.

If, however, all efforts to locate and remove the stone, or stones, in very large, deep disorganized cavities prove futile, the best policy is to drain the

anchored kidney for two or three weeks (v. p. 357) – during which time considerable decrease in size of the kidney will usually have taken place owing to drainage – and an examination then made is more apt to be successful in locating the stone – and its removal easier.

In connection with phosphatic calculi occurring in connection with infection of the renal pelves by colon bacilli, and which are frequently so brittle as to break under forceps and require to be removed by a spoon and their site cureted, Newman states that if the urine be alkaline, the cavity in the anchored kidney should be irrigated twice daily and a fluid culture of pure lactic acid bacilli deposited within the cavity, through the drainage-tube – so that the lactic acid fermentation weakens or destroys the urea-decomposing organisms, and the resulting acid dissolves the phosphates.

When a single calculus is discovered and removed it must not be considered that no others are present – until a thorough examination immediately after (and, sometimes, some days after) makes this seem likely.

A branched calculus may be so tightly wedged in its bed as to require that it be broken up and removed in parts.

Comments.—Insinuate the index-finger (of that hand corresponding with the kidney involved) beneath the fatty capsule, through the freeing incision, and feel the organ by palpating it between thumb and index, counterpressure being maintained the while. If the stone be palpated, steps for its removal may be at once undertaken. If the stone be not detected by palpation, several means of investigation are available: (*a*) While the kidney is steadied, a small, long, solid needle may be thrust in various directions, entered at the external border and thrust toward the hilum – being withdrawn between each thrust. This is the simplest and best instrumental exploration. (*b*) A special sound may be passed through an incision made in one of the lowest calices and the pelvis of the kidney thus examined, or a finger may be introduced – chiefly indicated when a stone is impacted there and is not removable from the external border of the kidney. (*c*) An incision posterior to the convex border of the kidney, lengthwise of the kidney, may be made – passing as far into the substance of the organ as indicated, even into the calices.

Methods (*a*) and (*c*) are to be preferred to opening the pelvis of the kidney, which is apt to be followed by fistula.

When located, the stone is cut down upon by the most direct route, by a straight incision from the cortex toward the hilum – and, when reached, the calculus is removed by the finger alone, or aided by special scoop or forceps – or may be broken and removed in pieces.

Having removed the calculus, and cleansed by douching or gauze sponging, as indicated, the site occupied by the stone, the wound in the kidney, in clean cases may, exceptionally, be repaired by fine catgut (see Nephrorrhaphy), and temporary drainage down to the kidney established. It is safer to temporarily drain the kidney wound itself. If purulent conditions be present, the kidney wound must not be entirely sutured – and drainage of the pus cavity must be instituted.

Following free incision of the kidney substance considerable hemorrhage is apt to occur at first, but is generally capable of speedy arrest by gauze pressure, or hot douching – or, these failing, by compression of the pedicle. Incisions into the kidney substance should be made in a straight line toward the hilum (centering toward the hilum like the spokes of a wheel) – or axially.

To aid in examining the pelvis of the kidney turn the external border of the kidney upward and forward.

In manipulating near the anterior wall of the kidney take care lest the peritoneal cavity be entered.

Where the kidney has been exposed by an anterior incision (transperitoneal) and drainage is necessary, a posterior counteropening should be made by cutting from without down upon some instrument pressed against the lumbar wall from within. The peritoneum is then closed over the anterior aspect of the kidney, and the posterior wound, with drainage, is left open. These remarks just made apply to the sometimes indicated removal by a posterior incision of a stone which has been discovered during an anterior operation.

An operation for stone begun as a conservative procedure sometimes ends in the sacrifice of the kidney by excision. The two conditions under which this is most apt to occur are – extensive disorganization of the organ – and uncontrollable hemorrhage.

Authorities differ as to the choice of the route via the kidney and the route via the pelvis, where a stone is equally removable by either – some stating that the kidney route should be chosen, to avoid the greater likelihood of persistency of urinary fistula, in operating through the pelvis – while others consider preferable the route through the pelvis. Kelly and Burnham state: "Whenever it can be done with safety, the stone in the pelvis of the kidney ought to be removed through the pelvis (pyelotomy), and not through the kidney tissue" – that pyelotomy is usually a simple operation, "involving no hemorrhage, not even one drop" – and "absolutely free from any mutilation" – the reverse of the conditions obtaining in operating through the kidney proper. They consider the removal of stone by pyelotomy contraindicated, however, where the kidney is more or less immovably fixed – in which cases removal through the dorsum of the kidney is to be preferred.

One of the dangers of bleeding during kidney operations is that of clotting of blood in the ureter, with subsequent urinary blockage.

It will sometimes be necessary to control hemorrhage by the ligation of vessels within the kidney substance where this is possible – or by special forms of transfixing sutures in the approximation of the kidney surfaces (v. pp. 347–351).

NEPHROSTOMY FOR PYONEPHROSIS AND FOR ANURIA

Description.—In diffuse suppurative nephritis, or pyonephrosis, under consideration, the condition is that of suppuration disseminated throughout the kidney substance, or pelvis, in the form of separated foci of pus, surrounded by zones of congestion. The kidney contains pockets or pouches, filled with pus or urine, or both. The condition may be the result of suppurative nephritis – or of the suppuration following the infection of a hydronephrotic kidney – or may follow infection from some lesion of the lower urinary tract. Nephrostomy consists in the establishment of a renal fistula.

Nephrostomy may also be indicated in unrelieved obstructive anuria (v. i.).

Nephrostomy is applied to the technic of suturing the margins of the incised kidney to the walls of the lumbar incision – for the purpose of drainage, which it is hoped will be of temporary, or intermediate duration – but which may be permanent. The incision opening the kidney also opens its pelvis.

Nephrotresis is sometimes employed to cover such prolonged or permanent kidney drainage as may be necessitated by irremovable ureteral obstruction, or following the excision of the bladder for such conditions as malignancy. In the present writing, however, the single term "nephrostomy" will be used to cover both conditions.

Indications for Nephrostomy.—(*a*) Obstructive anuria, unrelievable at the time of the primary operation. Where it is likely the distal obstruction, in kidney, pelvis, ureter, or bladder, may be removed by subsequent operation.

which may not be possible at the time, because of surgical reasons, or the patient's condition, the renal fistula may be only transient. Where, on the other hand, the obstruction is altogether irremovable, the nephrostomy becomes permanent. Calculus is the most frequent cause of mechanical obstruction. The condition is emphasized when the ureter of one kidney is obstructed (excretory anuria), while the secretory function of the opposite kidney is impaired; — (*b*) Some cases of pyonephrosis and hydronephrosis; — (*c*) Some cases of nephritis, accompanied by urinary suppression, or by marked renal hemorrhage; — (*d*) Nephrostomy with or without capsular decortication has been done in some reflex anurias; — (*e*) Nephrostomy has, latterly, been performed as a preliminary to operation for ectopia vesicæ, to temporarily divert the urine from the field of operation, — and, sometimes, as a permanent urinary exit in these cases, where no bladder operation is performed (and where, of course, the nephrostomy operation must be bilateral).

During the life of the renal fistula, provision must be made to catch the urinary, or mixed discharge, from the kidney opening — and these means will be mentioned below.

Drainage of the kidney fluids is accomplished by establishing connection between the pelvis of the kidney (into which all the calices drain) and the skin — which is usually brought about by an axial opening just posterior to the convexity of the kidney, into the pelvis of the kidney — and the anchorage of the kidney wound into the lumbar wound.

Nephrostomy for calculous anuria — and for pyonephrosis — will be considered.

Nephrostomy for Calculous Anuria.—The technic of the procedure is, here, practically the same as that in nephrotomy for calculus, followed by drainage (v. p. 353). It is necessary, in these cases, to operate expeditiously and with minimum shock — so that the simplest procedures are often the only ones which can be wisely performed — and sometimes analgesia is indicated instead of anesthesia. The kidney is exposed by the lumbar incision — and conducted, in all respects, as described under nephrotomy for calculus — up to the incision into the kidney and pelvis. If a stone be detected, and the patient's condition permit, an effort should be made to remove it — otherwise one should be satisfied with performing a simple nephrostomy — leaving the stone or stones to be removed at a later operation — the pressing need being to secure functionation of the kidney. Sometimes no stone can be detected at this operation, and if the patient's need be pressing, no time is lost in hunting for it. Especially should no attempt be made to do a radical operation at this stage to overcome ureteral obstruction in a patient in bad condition. Stones in the pelvis are usually easily removed — and, if high up in the ureter, they may sometimes be readily pushed up the rest of the way, and thus be brought within reach. If the calculus, or calculi, have been removed, and all is favorable, it is well to demonstrate the freedom of the ureter from obstruction by stone, or clot, by the passage of a ureteral catheter from the pelvis to the bladder.

In concluding the operation, if one be satisfied that the object of the operation has been fully accomplished and that no distal obstruction exists, the wound in the kidney may be sutured rather snugly around the rubber tube drain which passes through the parenchyma and into the pelvis of the kidney (v. Fig. 4470) — and the lumbar wound sutured up to the exit of the drain. If, on the other hand, the operation has been only partially completed, or there be any question as to the patulousness of the distal tract, the kidney wound should not be sutured at all closely around the rubber drain — but the margins of the kidney wound should be sutured, by chromic catgut sutures,

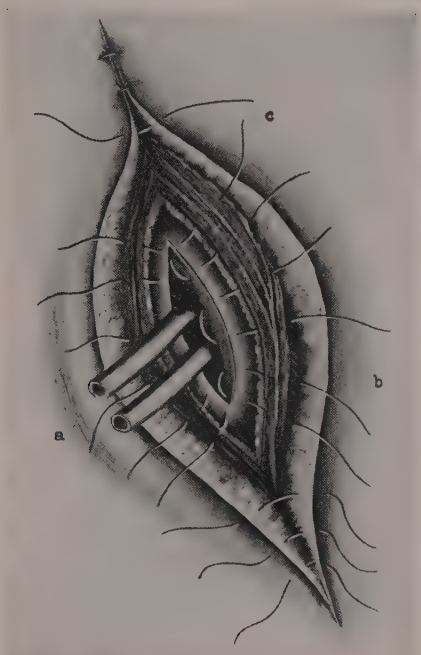


Fig. 4470.—Nephrostomy for Renal Abscess _ III: _ a, Double rubber tubes draining the pus cavity of the kidney; _ b, c, mattress-sutures approximating the margins of the kidney wound to the margins of the lumbar wound. The rest of the wound, up to the drains, is closed by ordinary deep and superficial sutures.

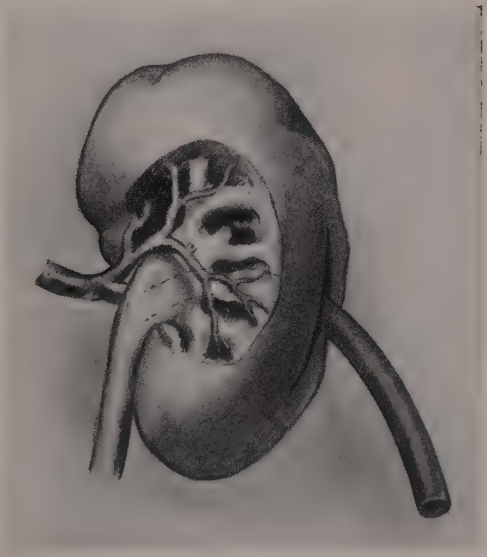


Fig. 4471.—Section View of the Drainage of the Renal Parenchyma and Pelvis in Nephrostomy.

of the mattress type, into the muscular walls of the lumbar wound _ as shown in Fig. 4470 _ and into the kidney wound, a large soft-rubber tube, or two

intermediate ones, with or without a strip of gauze packing, is placed and the lumbar wound only partially closed, from the ends, leaving, in the center, comfortable escape for the drains. A sectional view of the drain in position is seen in Fig. 4471.

In those cases in which there has been a satisfactory re-establishment of kidney function, the drain may be withdrawn as soon as the condition of the kidney wound warrants it (generally within ten days). If there be no distal obstruction the renal fistula usually soon heals. During the time that the patient may be passing urine through the fistulous opening, some mechanical arrangement for the collection of urine is devised so that the patient passes urine into a vessel in the bed or under the bed. In those cases where lumbar drainage continues for some time after the patient is up, or permanently,

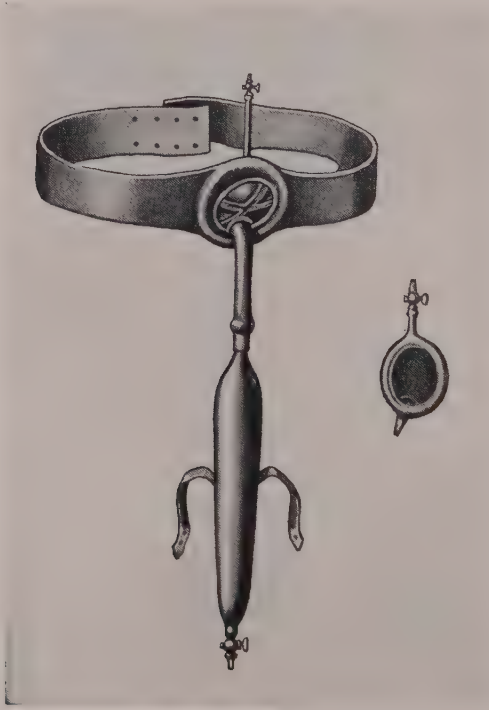


Fig. 4472.—Rubber Urinal for Renal Fistula.

some form of urinal (such as that shown in Fig. 4473) is worn with which the patient may get about. Another type of receptacle for renal drainage is shown in position in Fig. 4473.

Nephrostomy for Pyonephrosis.—The kidney is exposed by the lumbar incision and brought into the wound but with as little stripping of the perirenal connective tissue as possible, in these pus cases. In many instances a pyonephrotic sac will be readily recognizable and, in such cases, it is well to draw off most of the contained fluid by puncture and suction drainage, as the subsequent soiling of the wound will be less. The incision is then generally made over the prominence of the sac and, thence, into the pelvis of the kidney. In other cases, no guide exisiting, the kidney may be incised para-axially, just posteriorly to the convexity, cutting through the parenchyma and into the pelvis. Once within the kidney, a thorough digital examination is made,

especially for separated loculations of pus _ and all intervening septa between such collections of pus should be broken down, or cut through, if necessary, with scissors _ so as to bring all pus spaces into communication and accessible to drainage. If bleeding vessels be encountered, they are clamped and tied _ but are apt to be much atrophied under the circumstances.

The kidney infection in these cases may result from the infection of the preceding hydronephrosis, or may have come from some other infection lower down in the urinary tract. The outlook of the operation will depend greatly upon the condition of the urinary tract below the kidney, for if there be unrelieved obstruction in that part of the course, the renal fistula is due to be permanent. The two factors which will weigh most heavily in determin-

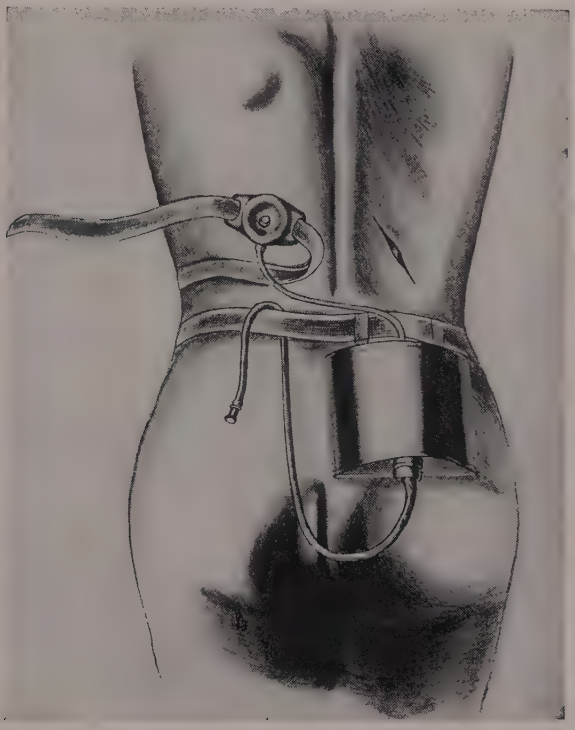


Fig. 447 .—Watson's Shield and Receptacle for Renal Drainage Through the Loin; _ The anterior aspect of the shield is turned backward _ ready to be applied to the nephrostomy or ureterostomy wound of the opposite side.

ing the Surgeon to adopt nephrectomy instead of nephrostomy, will be the patulousness or otherwise of the urinary tract below the kidney, and the amount of disorganization of kidney tissue encountered.

It is of practical and valuable aid to have passed a ureteral catheter, upward well into the kidney, from below, before the operation, and to have kept it anchored *in situ.* It aids during the manipulations of the operation, and it especially aids in postoperative drainage, for it has been shown that it may be retained for days or weeks. Before the completion of the operation the ureteral catheter originally passed is sometimes used to draw down, from the kidney opening, a larger ureteral catheter, attached to the smaller one.

All débris, stones, and exfoliated tissue should be thoroughly cleared away from the opened-up pockets, and the cavities cleansed by wiping with gauze and by irrigation. If pus-pockets have been emptied by suction drainage, it is well, while the suction drain is still in position, and before incising the pus-sac, to irrigate it with some appropriate antiseptic solution.

In those cases where a ureteral catheter has been used, it is anchored to the penis, in the male, and to the pubic hair, in the female — and to its kidney end a piece of silk is tied, and this is brought out of the lumbar wound. By this means ureteral catheters may be changed during the period of drainage if necessary.

The margins of the kidney wound are anchored into the margins of the lumbar wound, as described and pictured under Nephrostomy for Calculous Anuria (v. pp. 357–362). Usually two rubber tubes are carried into the kidney, with a strip of gauze packed between them.

Before closing the wound all drainage-tubes should be tested by irrigation, including the ureteral catheter.

During convalescence varying proportions of urine and pus will flow through the fistula and ureteral catheter, dependent upon the nature of the special case. The dressings are changed frequently at first — and irrigations made once or twice daily (with such solutions as a 1 : 1000 silver nitrate, in plain sterile water, or boric acid solution). The perirenal drain, if one be employed, can usually be withdrawn the latter part of the first week — and the kidney drains that come out of the lumbar wound, as soon as the urine becomes fairly clear (showing no thick pus or débris), which is generally within two or three weeks. The last drain removed, ordinarily, is the ureteral catheter — usually within four or five weeks.

PYELOSTOMY

Pyelostomy is the application, to the renal pelvis, of the technic of nephrostomy (v. p. 357) — and consists in the establishment of a temporary or more or less lasting drainage of the pelvis of the kidney through a lumbar incision. In pyelostomy the pelvis of the kidney is opened and attached to the lumbar wound for drainage — and, in nephrostomy, the kidney itself, usually the convex border, is sutured into the lumbar wound for the same purpose.

In the one there is the danger of a more or less lasting fistula of the kidney — and, in the other, of the pelvis of the kidney — the likelihood of the latter being greater and, especially, in either case, if there be any obstacle to the free and easy outflow of urine from the kidney.

While a kidney incision, if of the convex border, can be sutured higher into the wound, the incision of the renal pelvis usually necessitates its anchorage into the lower plane of the lumbar wound. A rubber drain is anchored in the incised renal pelvis by a catgut suture and conducted through the lumbar wound, which is sutured up to its exit. The drain is left in for a few days and then withdrawn, when its mission is completed. If the outflow of urine be unimpeded, the closure of the pelvic fistula is sought. In other cases it may be planned to again expose the parts, in the tract of the still patent fistula, and resort to some more radical operation than was possible at the time of the original procedure — for the purpose of radical cure of the primary pathologic condition.

OPERATION FOR THE CLOSURE OF RENAL FISTULA

Renal fistula is most apt to be encountered as the result of a persisting sinus following operation for nephrostomy — and, in this case, will usually lie directly in the line of part of the scar of the original nephrostomy operation.

If a probe or, better, ordinary rubber catheter, or bougie, can be passed from the skin, into the kidney, the operation is made much easier. After passing the instrument through the tract and leaving it in position, an incision is made for the dissection of the sinus — the center of which will be the fistulous opening (the incision starting afresh just outside of each side of the mouth of the fistula, without involving it). The incision may lie in the path of the incision through which the original operation was performed. As soon as the mouth of the fistula is dissected free, from which the instrument is projecting, the freed upper end of the fistula is tied around the instrument which is within its lumen — and which, henceforth, serves to give form, position, and recognizable size to the sinus. The tract, with the enclosed bougie, is carefully dissected out down to the kidney — using great care to nowhere cut into the sinus. When the kidney surface is reached, still continue the dissection of the sinus a short distance beneath the level of the kidney surface — by excising a shallow limited ellipse of superficial kidney substance. In the depth of the site of the ellipse, and before the final division, the fistulous tract is ligated with catgut — after which the elliptic piece of kidney surface, inclusive of the sinus, is excised — and the margins of the elliptic wound in the kidney are brought together by catgut sutures.

The tract of the wound down to the surface of the kidney should be temporarily drained if it be thought to have been infected from the sinus — but drainage may be otherwise omitted.

OPERATIONS FOR URONEPHROSIS AND FOR UROPYELONEPHROSIS

Description.—Uronephrosis, sometimes termed hydronephrosis, designates a condition of distention of the calices and renal substance with aseptic urine — and, uropyelonephrosis, a similar distention of the kidney pelvis, calices, and kidney substance. In pyonephrosis, which has been considered (v. p. 357), the distending fluid consists partly of pus. A uronephrosis may be infected without yet having become purulent. In the condition of uropyelonephrosis, to be here considered, the pelvis, calices, and substance of the kidney may be distended in varying degrees.

Broadly speaking, any condition which causes obstruction to the urinary outflow from the kidney may lead to uronephrosis or to uropyelonephrosis — and this obstruction may be within or without the urinary tract, from kidney to meatus. Some degree of retention of urine, with, simultaneously, some degree of distention of the kidney pelvis and calices occur. The condition occurs more frequently upon the right than on the left side — and in women than in men — at any period of life. Some observers report bilateral uronephros is more common than unilateral — and others report unilateral uronephrosis as the more common type (which seems more likely).

Among the most frequent causes of uronephrosis may be mentioned the following: — abnormal development — movable or abnormally placed kidneys — ureteral obstruction, as of calculi — ureteral strictures — ureteral kinks, bends, and twists — ureteral valves — adjacent adhesions — high or oblique ureteral insertion into the kidney pelvis — constriction of any part of the urinary tract distal to the kidney — and outside pressure, as of tumors, and the like, in any part of the tract of outflow from the kidney. Movable kidney is the commonest cause — and especially exaggerates coexisting causes.

It is to be noted that for obstruction to cause uronephrosis the obstruction, if complete, must be repeated at intervals, and be of short duration, — or, if incomplete, it must occur repeatedly, and be of long duration, or constant. If obstruction be complete, constant and permanent uronephrosis does not occur — but, in its place, sclerosis of the kidney.

Many surgical measures have been devised to relieve uronephrosis – of which those most frequently employed will be briefly considered.

As palliative measures, for immediate relief of symptoms, catheterization of the ureters – and aspiration of the uronephrotic sac through the lumbar region – have been performed.

As an extreme measure the kidney is sometimes excised.

The midclass – of radical, conservative measures – is the chief field for surgical exploitation.

Kidney Fixation.—As movable kidney is the one most frequent cause of uronephrosis, the operations for movable kidney (v. pp. 382–400) assume first importance in the treatment of this condition. Not only is displacement of the kidney a predisposing cause in the production of uronephrosis, but is most apt to exaggerate any local condition of the calices, pelvis, or ureter which may coexist.

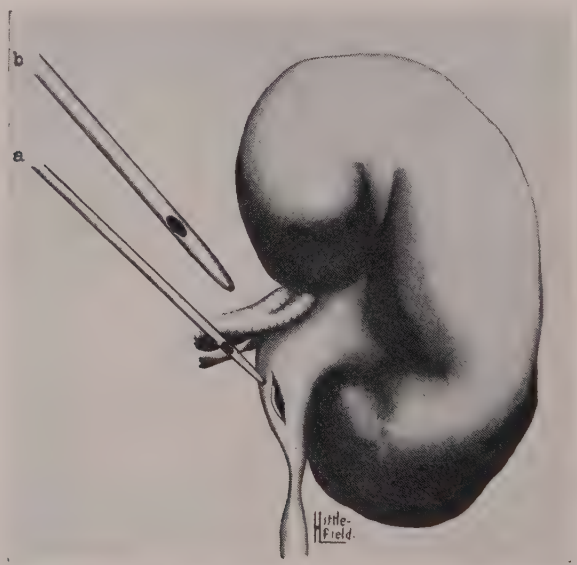


Fig. 4474.—Dilatation of a Constricted Ureter Through an Incision Made in the Pelvis of the Kidney; – Progressively increasing sizes of bougies or sounds are being passed at the one séance.

Operation for Uronephrosis and Uropyelonephrosis by Nephrostomy or Pyelostomy, the technic of which has been described (v. pp. 363–364), has sometimes, though rather unexpectedly, resulted in cure – but must not, logically, be counted upon as other than a palliative means of meeting an emergency – or as preliminary of some more radical measure – or as a part of such more radical procedure.

Operation for Uronephrosis and Uropyelonephrosis Caused by a Strictured Ureter by Dilatation of the Stricture Through a Pyelotomy Wound.—Kelly and Burnham report a case of uronephrosis which remained without returning symptoms for ten years, in whose instance the only treatment consisted in incising the pelvis of the kidney and dilating the strictured ureter with bougies of increasing size (Fig. 4474).

Operation for Uronephrosis and Uropyelonephrosis Caused by Stricture of the Ureter by Ureteroplasty.—An axial incision is made through the presenting wall of the stricture, as it is exposed in the lumbar



Fig. 4475.—PYELO-URETOPLASTY FOR CONSTRICTION OF THE URETER _ I; _ The presenting wall of the strictured portion of the pyelo-ureteral junction is incised axially.

wound (Fig. 4475) _ after which the margins of the ureteral wound are sutured together transversely by non-penetrating, fine chromic catgut sutures (Fig. 4476).



Fig. 4476.—The Same _ II; _ The axial incision of the pyelo-ureteral junction is being sutured transversely _ thus increasing the lumen at the site of constriction.

Operation for Uronephrosis and Uropyelonephrosis, Caused by Stricture at the Pyelo-ureteric Junction, by Pyelo-ureteroplasty.—The stric-

ture, instead of being in the course of the ureter proper, as in the preceding operation, is situated directly at the junction of the pelvis with the ureter.

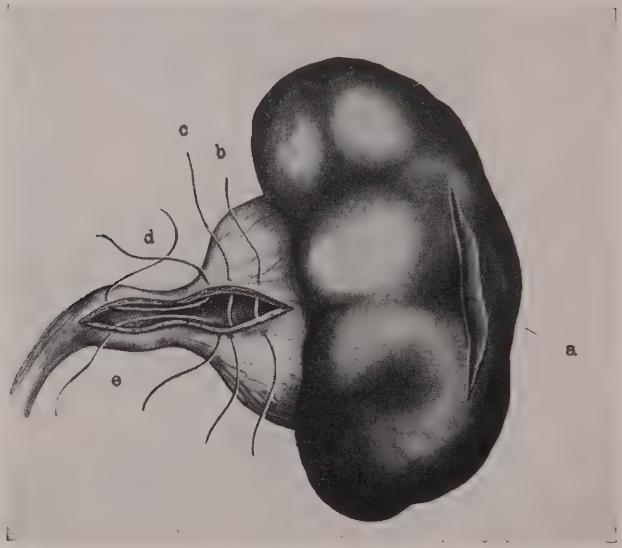


Fig. 4477.—Pyelo-ureteroplasty for Contracted Pelvic Outlet – Fenger's Operation – I;– The stricture has been split axially. The sutures, **d, e,** in the narrowed part of the ureter, are placed in the axis of the cut, to broaden the caliber when tightened – while those in the widened portion of the pelvis, **b, c,** are placed transversely. An incision into the convexity of the kidney is shown at **a.** (Figs. 4477 and 4478 redrawn from Kuemmel.)

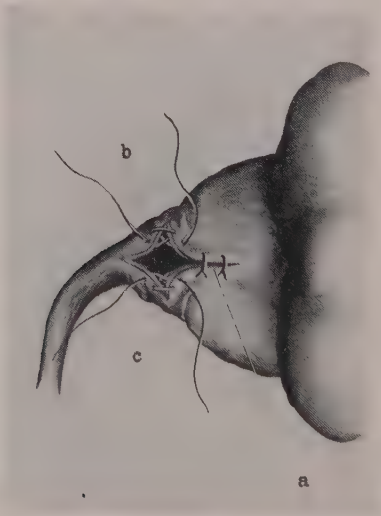


Fig. 4478.—The Same – II; – The wound in the pelvis, next to the kidney, has been closed axially by tying the sutures previously shown – while, in this case, the outer parts of the incision through the narrowed portion of the pelvis is being closed, transversely, by shoe-lacing sutures, after which the axial, interrupted sutures will be continued.

The axial incision is then made partly over the pelvis and partly over the ureter – and is sutured, by non-penetrating stitches, in the opposite direction.

Operation for Uronephrosis and Uropyelonephrosis Caused by Contraction of the Pelvic Outlet, by Pyelo-ureteroplasty (Fenger).—The axial incision passes well into both pelvis and ureter _ after which a combination of fine, non-penetrating catgut sutures is applied. Where the caliber is least, two sutures are placed, axially, one on each side (Fig. 4477, **d** and **e**). These are tied in such a way as to fold together the margins of each side, transversely (Fig. 4478, **b** and **c**, where penetrating, shoe-string sutures are shown). When these are tied, the width of this hitherto narrowed site is greatly increased. The rest of the axial incision is sutured so as to approximate their margins in the axis of the outlet.

Operation for Uronephrosis and Uropyelonephrosis Resulting in Dilatation of the Renal Pelvis, by Pyeloplication.—The lateral view of such a dilated pelvis is shown in Fig. 4479. Transversely running sutures,



Fig. 4479.—Dilated Kidney Pelvis Above a Constriction of the Ureter.

non-penetrating, are placed in such manner (Fig. 4480) as to approximate the outlying borders of the dilated pelvis _ and, when these are tied, the redundancy of pelvis wall will be infolded upon itself, resulting in the adhesions ofits folds.

Operation for Uronephrosis and Uropyelonephrosis, Caused by a Kink at the Pyelo-ureteral Junction, by Combined Pyeloplication and Pyelo-ureteral Straightening Suture (Israel).—Not only is the excess of pelvic sac here taken up by transversely placed non-penetrating sutures, which, when tied, plait the pelvis axially (Fig. 4481, **a, b**) _ but a straightening suture is also placed in such a manner as, when tied, to straighten the bend which the beginning of the ureter makes, pathologically, with the pelvis of the kidney (Fig. 4481, **c, c**).

Operation for Uronephrosis, by Capitonnage, or Plaiting of the Kidney Pouch (Israel).—The loose and redundant kidney wall is plaited by a series of sutures placed in such manner as to materially lessen the bulging sac, when they are tied, and infold the surface of the kidney. The number

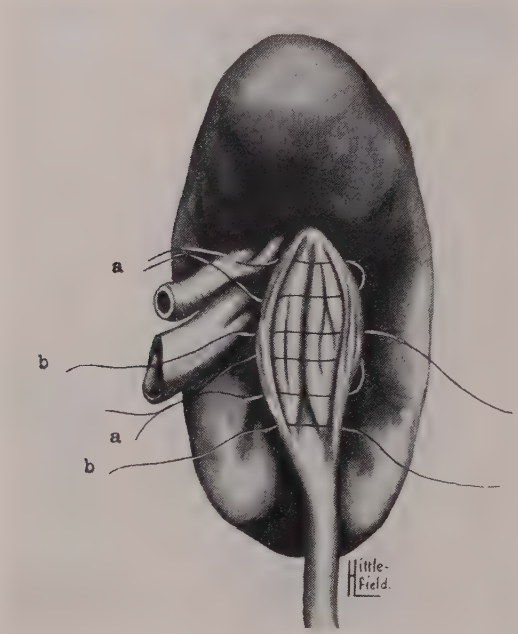


Fig. 4480.—Pyeloplication, for Enlarged Kidney Pelvis Due to Ureteral Obstruction Which Has Been Relieved; – The redundant pelvis is infolded upon itself by mattress-sutures, a, a, or by ordinary sutures, b, b. The sutures should penetrate some of the adjacent perirenal fascia (not here shown).



Fig. 4481.—Pyeloplication Following Pyelotomy for a Kink at the Pyelo-ureteral Junction – Israel's Technic: – a, Sutured pyelotomy wound (which may have been made for stone extraction); – b, plication sutures; – c, c, suture planned to straighten the pyelo-ureteral curve.

of parallel folds which these stitches pick up will depend upon the size and position of the uronephrotic sac (Fig. 4482).

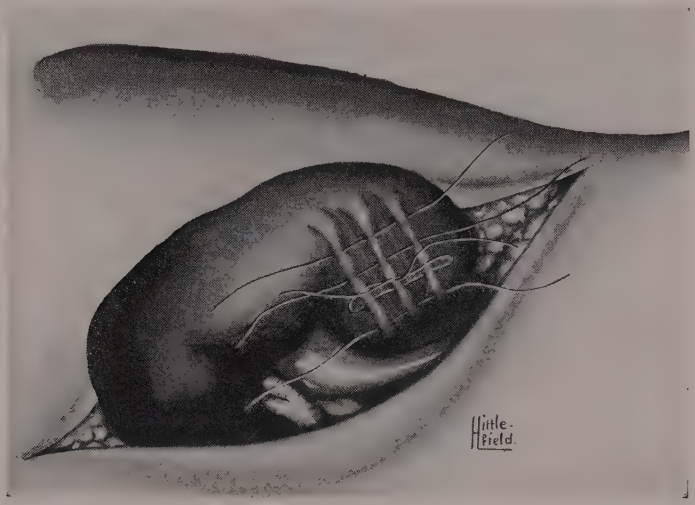


Fig. 4482.—Capitonnage, or Plaiting of a Kidney Pouch in the Lower Pole of the Kidney, Below the Level of the Ureteral Entrance _ Israel; _ The redundant tissue is being brought together by parallel plaits by Lembert sutures.

Operation for Uronephrosis and Uropyelonephrosis, Caused by High Valve Formation at the Pyelo-ureteral Junction, by Transpelvic Division



Fig. 4483.—Israel's Operation for Pathological Pyelo-ureter Valve _ I; _ The sigmoid kink.

of the Valve or Spur (Trendelenburg).—In cases where this type of operation is applied, the ureter, at its exit from the pelvis, not only has a spur, or valve,

embarrassing the outlet, but the emptying of the pelvis is made additionally difficult because the outlet from the pelvis, the pyelo-ureteral junction, is placed at the upper rather than at the lower aspect of the renal pelvis (Fig. 4483). The pelvis of the kidney is here incised from without inward _ over the outer wall of the portion of the spur which projects outward (the upper curve of the S) _ after which the double wall of the portion of the spur projecting inward (the lower curve of the S) is divided. The opposite walls of the cut lower curve of the S are sutured together (Fig. 4484, **c, d, e**) _ and then the margins of the outer incision of entry are sutured _ thus straightening out the pyelo-ureteral junction.

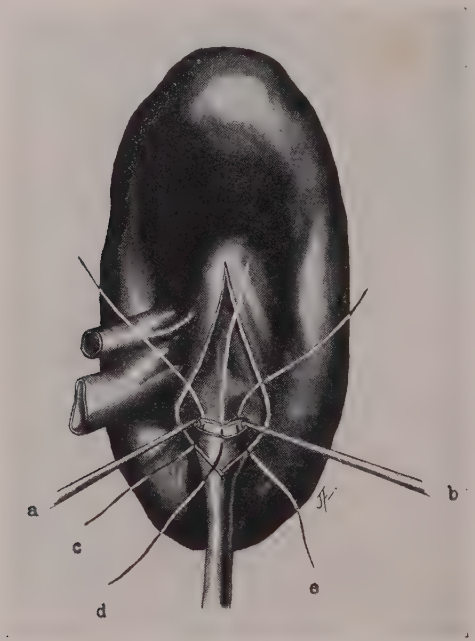


Fig. 4484.—The Same _ II; _ The pelvis has been incised axially, exposing the S-shaped spur, which is likewise incised in the axis of the kidney _ and sutured in the same axis _ thus removing the elevated spur obstructing the outlet.

Pyelo-ureterostomy, by Transpelvic Incision, for Lowering the Elevated and Valvular Pyelo-ureteral Outlet, in Uropyelonephrosis (Morris). —This is, in effect, practically the same procedure as just described as Trendelenburg's spur operation _ except that it is accomplished in a somewhat different manner. Through the slightly enlarged trocar puncture in the upper part of the pyelonephrotic sac, by which the excess of fluid is first withdrawn, both blades of a pair of scissors are passed from above downward _ one blade passing into the pelvic sac, and the other blade into the beginning of the ureter (Fig. 4485). When these blades are closed the two intervening walls, pelvic and ureteral, are divided, thus cutting away the spur, and lowering the outlet from the renal pelvis. The margins of the two walls are then sutured together, as shown in Fig. 4486, **b** _ and then the wound of entrance, at **a**.

Operation for Uronephrosis and Uropyelonephrosis, Caused by High Valve Formation at the Pyelo-ureteral Junction, by Transrenal Division of the Valve or Spur, Followed by Pyelo-ureteral Anastomosis.—The site

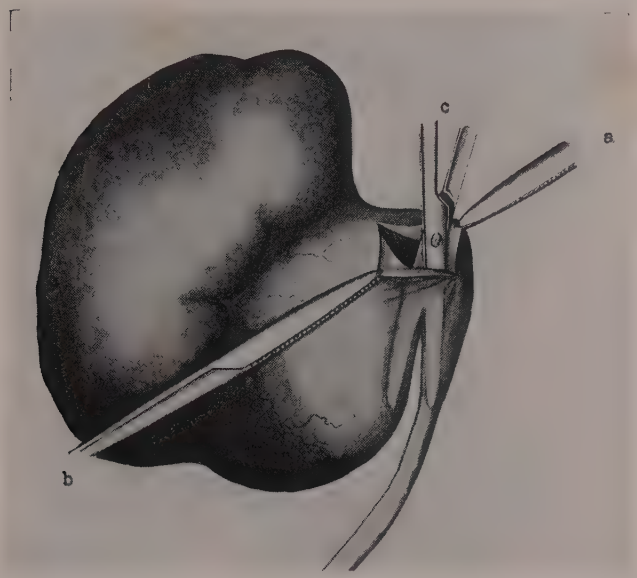


Fig. 4485.—Pyelo-ureterostomy for Lowering the Ureteral Outlet of the Dilated Pelvis _ Morris' Technic _ I; _ Through an incision in the pelvis, one blade of the scissors is carried more deeply into the pelvis _ and the other into the ureter _ their closure then cutting both structures to the same depth. (Figs. 4485 and 4486 modified from Morris.)

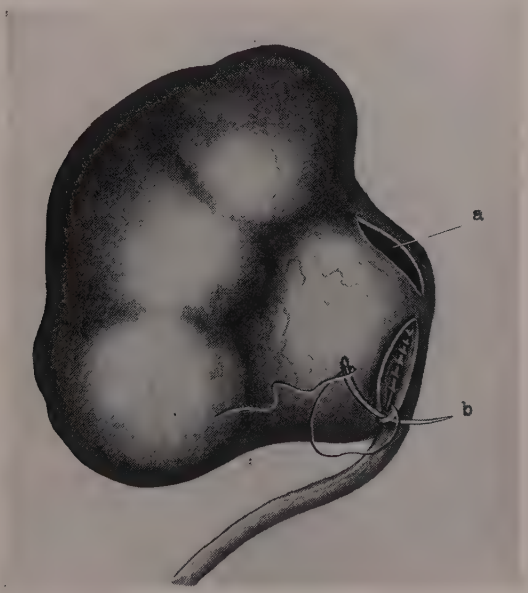


Fig. 4486.—The Same _ II; _ The margins of the common opening between pelvis and ureter are united by a continuous overlap suture of fine chromic catgut.

at which the anastomosis between renal pelvis and ureter is to be made is shown in Fig. 4487, from **a** to **b**. The final result of the operation, accomplished by a different route, is the same as in the two operations just considered.

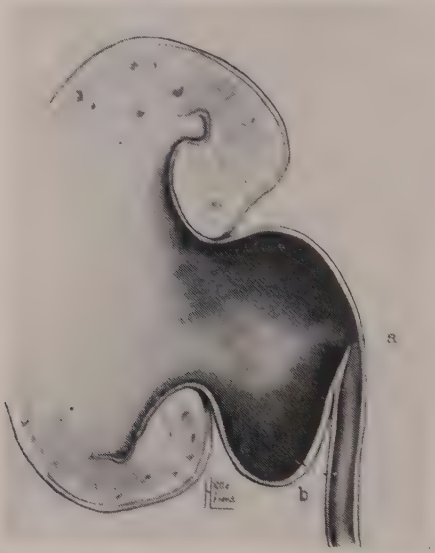


Fig. 4487.—Site of Pyelo-ureteral Anastomosis Seen in Section.

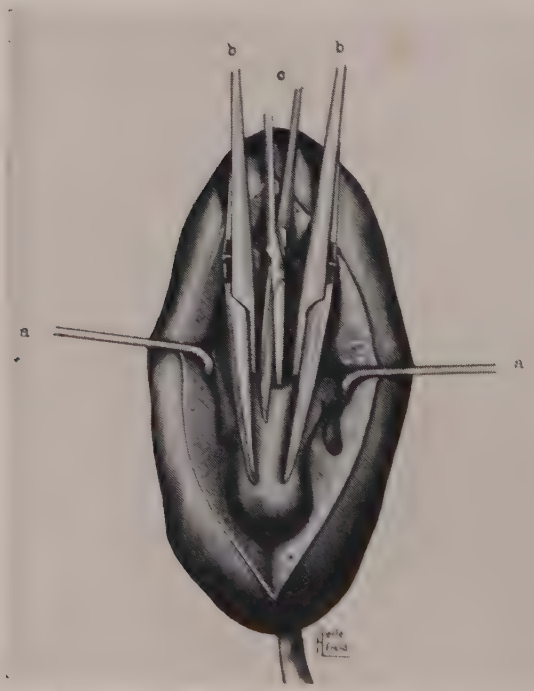


Fig. 4488.—Incising a Ureteral Spur from Within the Kidney.—1:—a, a, Retractors of the halves of the split kidney;—b, b, clamps controlling hemorrhage outside of the line of section;—c, scissors dividing the spur.

The present technic is applied through the axially bisected kidney—and would be the natural procedure in those cases in which the kidney had, independ-



Fig. 4489.—The Same – II: – a, b, Retractors of the split kidney; – c, ureteral bougie in retrograde catheterization; – d, continuous suture of the margins of the incised spur.



Fig. 4490.—Lateral Pyelo-ureterostomy – Albarran; – The margins of the two openings are sutured together by through-and-through fine catgut stitches – reinforced by Lembert sutures of the outer coats.

ently, been laid open, and the need of the present operation found. When the pyelo-ureteral junction is exposed, two clamp forceps, placed parallel, are made to clamp the structures in such a manner that one blade of each forceps

is in the pelvis of the kidney, and the other blade of each, in the ureter. After the blades have been reasonably compressed the spur is divided between them (Fig. 4488), thus leaving a deep V _ the contiguous walls of which are sutured as shown in Fig. 4489.

Lateral Pyelo-ureterostomy, for Uropyelonephrosis, Caused by High Valvular Pyelo-ureteral Outlet (Albarran).—The renal pelvis and the upper part of the ureter are freed and brought conveniently into the field _ after which both the pelvis and the ureter are limitedly incised, axially, and a lateral anastomosis brought about between the incised side of the ureter and the lower aspect of the pelvis _ where, by the most dependent route, the pelvis may empty its contents into the ureter _ as seen in Fig. 4490.

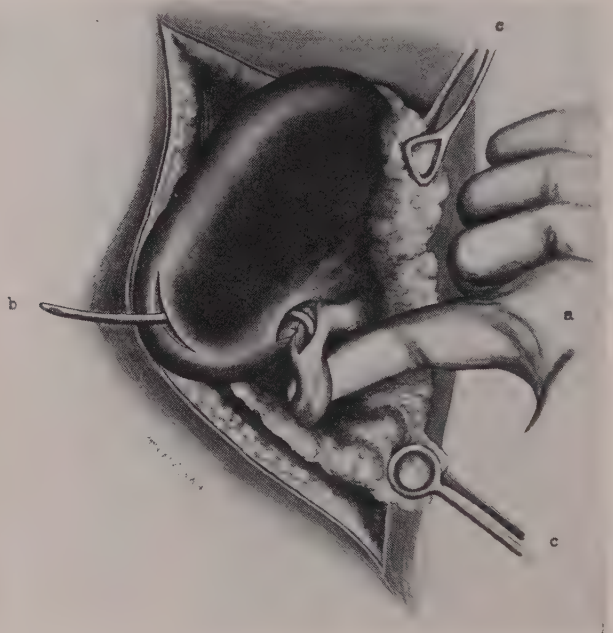


Fig. 4491.—Lateral Pyelo-ureterostomy _ Albarran; _ An incision is made through the convex border of the lower pole of the kidney, into its cavity _ and, another continuous with it, upon the pelvic aspect of the kidney. A corresponding incision is then made in the lateral aspect of the ureter, below the dilated pelvis and constricted portion of the ureter _ and the two openings anastomosed _ after which the convex kidney wound is closed. A ureteral bougie is seen passing through the kidney into the ureter.

Operation for Uropyelonephrosis by Combined Lateral Pyelo-ureterostomy and Nephrostomy (Albarran).—The first steps of the operation are, practically, the same as in the procedure last described _ except that a ureteral catheter has been previously passed from the urinary meatus, so that its tip lies within the field of operation. The lower aspect of the renal pelvis and the lateral aspect of the ureter, at a corresponding level, are incised. The posterior lips of the wound are sutured (Fig. 4491), after which an incision is made through the cortex and parenchyma of the lower pole of the kidney _ and the tip of the ureteral catheter is drawn through this incision in the kidney. The anterior lips of the pyelo-ureteral anastomosis are then united by suture, thus completing the pyelo-ureterostomy. The incision in the lower pole of the kidney and the emerging tip of the ureteral drain constitute the temporary nephrostomy.



Fig. 4492.—Terminal Pyelo-ureterostomy – Krogius; – The ureter is divided just below the dilated pelvis and ureteral constriction – its proximal end ligated – and its terminal end, after being beveled, sutured into an obliquely made opening in the dependent portion of the kidney pelvis. (Modified from Albarran.)

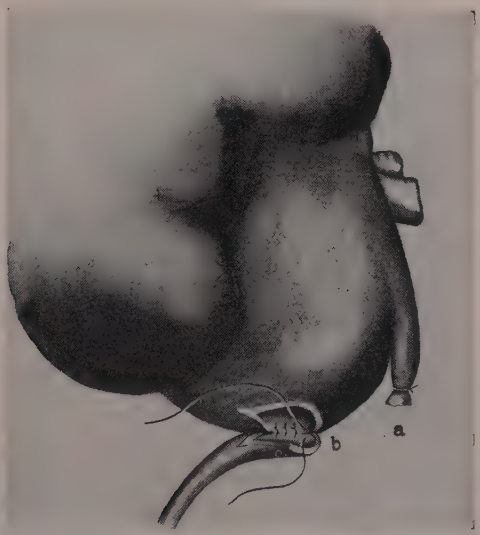


Fig. 4493.—Terminolateral Pyelo-ureterostomy – Kuester: – **a,** Ligated proximal end of the ureter; – **b,** site of anastomosis of the obliquely cut distal end of the ureter sutured into the incised pelvis of the kidney. (Modified from Legueu.)

Operation for Uropyelonephrosis, by Division of the Ureter, Followed by Terminal Pyelo-ureteroneostomy (Krogius).—The kinked and strictured ureter is transversely divided below the ureteral deformity, and on a

level with the lower part of the renal pelvis. The proximal end of the ureter is ligated _ and the distal end is sutured into the lips of an incision made into the lower aspect of the pelvis (Fig. 4492). The anastomosis is made more satisfactory if the ureter be divided with slight obliquity, and a somewhat triangular incision be made into the renal pelvis _ which will make the suturing easier.

Operation for Uropyelonephrosis by Division of the Ureter, Followed by Terminolateral Pyelo-ureterostomy _ or Terminolateral Ureteropyeloneostomy (Kuester).—In this, as in the method last described, a new pyelo-ureteral junction or anastomosis is made. The steps are as in the preceding operation, except that instead of making an end-to-end anastomosis, in the manner there carried out, an oval opening is cut in the renal pelvis, and an oblique bevel is made of the end of the ureter _ the lips of the two

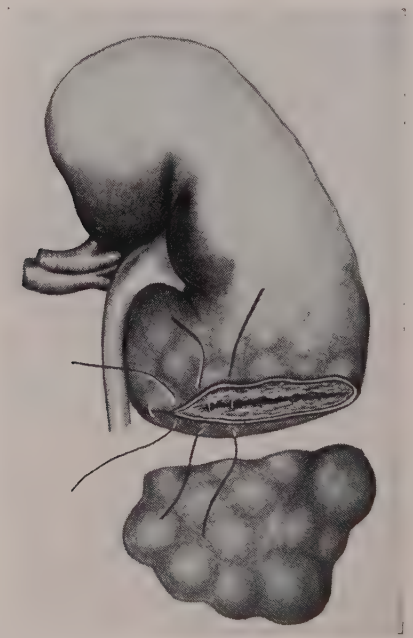


Fig. 4494.—Operation for Uropyelonephrosis by Resection of the Uropyelonephrotic Sac _ Albarran; _ Line of section _ and the resulting wound, in the act of being sutured.

structures then being sutured together (Fig. 4493), thereby hoping to secure a freer, larger opening of exit than in the last method.

Operation for Uropyelonephrosis by Resection of the Uropyelonephrotic Sac (Albarran).—The dilated and redundant portion of the sac, composed of either the renal pelvis alone or of both renal pelvis and kidney substance, is excised after clamping the parts proximally (Fig. 4494). The margins of the kidney and renal pelvis are then brought together by suture. The act of partial excision is the same, in technic, as that described in connection with partial excisions of the kidney for tumors (v. p. 401).

OPERATION FOR LACERATION OR RUPTURE OF THE KIDNEY

General Considerations.—The conditions which may arise as the result of traumatism to the kidney are many, immediate and remote _ and the

measures to meet them are correspondingly varied. Any of the wounds which may be inflicted upon the viscera may befall the kidney, and must be met according to their nature. A special form of traumatism to which the kidney is particularly exposed, owing to its position and relation to overlying ribs, is laceration, of minor grade, or to the extent of complete rupture, through the crushing effect of the wheels of vehicles passing over the fallen body, or the compression of the body between movable objects. It is with this condition that the present paragraphs deal.

Nor are the indications the same, as to surgical interference, in all cases. The operative measures usually employed in connection with wounds of the kidney are the following: – Simple exploratory exposure, for corroboration, or refutation of injury, to be followed by some special procedure, or not, as indicated (the exposure being by the lumbar or by the intraperitoneal route, as determined by the nature of the case), – incision for the evacuation of para-

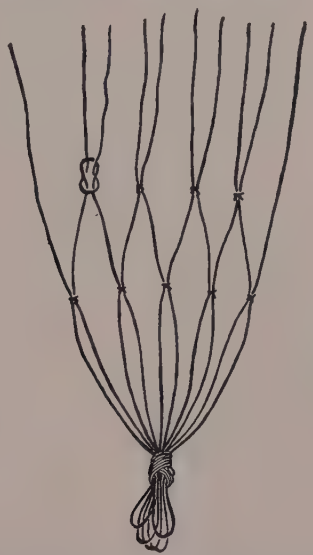


Fig. 4495.—Marcille's Catgut Fillet for Ruptured Kidney – I; – Hemorrhage is controlled and union of lacerations promoted by drawing the absorbable net around the kidney, and knotting it snugly at the still open end. (Figs. 4495 and 4496 redrawn from Albarran.)

nephritic blood or pus, – nephrotomy, for the evacuation of intrarenal blood or pus, – partial nephrectomy, of a seriously injured part of the organ, – total nephrectomy, of a hopelessly injured organ, – and exposure for the repair, by suture or other device, of an organ whose injury seems possible to meet by such measure.

Many of the technical procedures to meet these various indications have either been dealt with, or will be, in various parts of the work – so that only the one last mentioned will be here considered – the repair of the crushed kidney.

Repair of Laceration of the Kidney.—Upon exposing the organ, controlling hemorrhage, and removing disorganized tissue, if any, it may be found possible to repair minor grades of laceration by one of the methods of combined deep and superficial suturing already described under Nephrorrhaphy and Pyelorrhaphy (v. p. 346). On the other hand, while the kidney may seem too irregularly and extensively crushed for systematic suture, but yet hold out

the possibility of being saved, one of several devices for holding the lacerated parts together may be applied.

Marcille devised a fillet of catgut, knitted together like a fishing net – closed at one end, and temporarily open at the other (Fig. 4495). This network is slipped over the lacerated kidney, deprived of its fatty tissue – and the open end is then knotted about the opposite pole of the kidney (Fig. 4496). Finally, the net-held kidney is returned to its bed – in hope that union of its parts will have taken place before the strands of catgut of which it is made have been dissolved. Ample drainage, through the lumbar wall, is carried down to the wounded kidney.

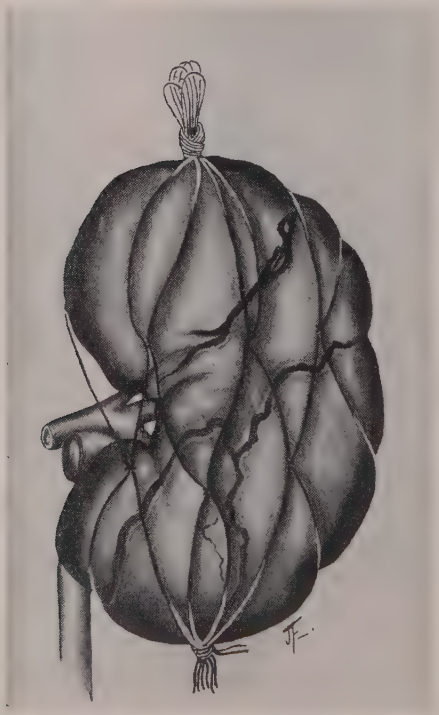


Fig. 4496.—The Same – II; – The catgut net applied to a lacerated kidney.

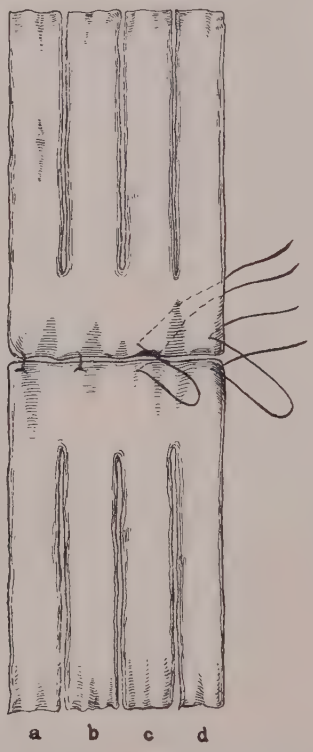


Fig. 4497.—Control of Kidney Hemorrhage – DaCosta's Method – I; – Four-tailed bandage made by splitting two rectangular pieces to near their bases – the left aspects of which are approximated by two tied catgut sutures – the opposite aspects being held loosely in relationship by two free catgut sutures. The ruptured kidney is then made to pass between the two central sutures, after which the two loosened sutures are tied beneath the kidney. (Figs. 4497 and 4498 modified from Guiteras.)

DaCosta's device is formed by uniting two pieces of a four-tailed bandage together with catgut suture in the manner shown in Fig. 4497. When the lacerated kidney is delivered into the wound this hammock-like sling is tied about the organ, as seen in Fig. 4498 – and subsequently, when the catgut ligatures dissolve, the two halves are drawn out from under the kidney, whose lacerated parts are, by that time, supposed to have united. Ample drainage is here provided as in the preceding technic – and the lumbar wound (through which the sling protrudes, even though the lacerated kidney may have been

discovered in some anterior or lateral operation) is closed up to the exit of the ends of the bandage.

It is desirable to know the condition of the opposite kidney and of the ureters before the patient is taken from the table — if the nature of the trau-

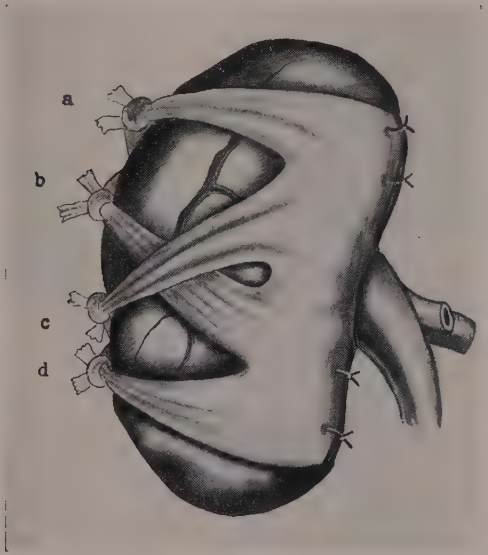


Fig. 4498.—The Same — II; — The four tails of the bandage are then tied over the kidney, as here shown — until absorption of the catgut sutures, by which the two halves of the bandage are held together, allow of their withdrawal. The letters in the two figures correspond.

matism suggest possible wounding of these — and if the patient's condition permit of extended investigation.

RENAL DECAPSULATION

Description.—The stripping of the kidney of the major portion of its capsule. The term "decortication" is sometimes, though incorrectly, used — as only the proper, fibrous capsule is removed from the kidney — being separated from the cortex of the kidney, which is not removed in any part. In renal capsulectomy the pealed-off capsule is either rolled over and sutured to itself or excised.

Indications.—Renal decapsulation is indicated, according to Walker, in the following conditions: — In chronic nephritis, with accompanying nephralgia, hematuria, and serious eclampsia; — In acute nephritis, with persistent edema, dyspnea, and toxemia; with oliguria, or anuria; and with increasing leukocytosis, and with the methylene-blue test indicating imperfect elimination; — Marked and constant nephralgia; — Protracted hematuria.

In this category of cases is included the acute nephritis connected with fevers, especially the scarlatinal nephritis of children.

Operation.—The kidney most involved (as determined by differential catheterization of the ureters) is sometimes first decapsulated — and the second kidney later. Sometimes both kidneys are operated upon at the same time.

The kidney is exposed by the lumbar route. When the organ can be delivered into the wound, the manipulations are easier, as the organ can be better

steadied during the decapsulation, and the backward pealing off of the capsule can be more readily and thoroughly accomplished. The capsule is divided axially along the convexity. This may be accomplished by nicking the capsule,

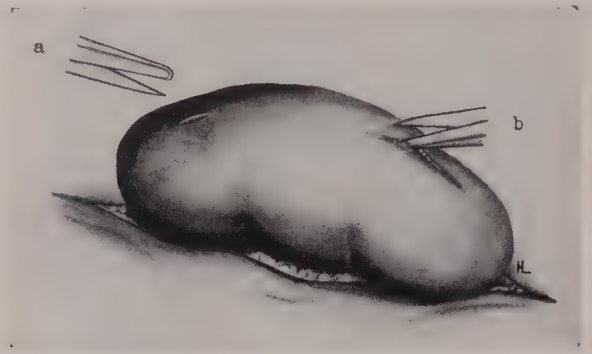


Fig. 4499.—Splitting the Kidney Capsule with Scissors – (two stages of one operation are shown): – a, The lower, pointed blade has penetrated the capsule; – b, the scissors are reversed, and the rounded blade, entering the nicked capsule, travels between the capsule and cortex, dividing the former.



Fig. 4500.—Decapsulation of the Kidney for Nephritis – (Edebohls): – a, Finger introduced posteriorly, to support the kidney during the manipulation; – b, toothed forceps grasping the margin of the incised fibrous capsule; – c, curved, blunt dissector, freeing the capsule from the kidney substance; – d, d, tractors of the perinephritic fatty areolar tissue, helping to hold the kidney forward in the wound during the freeing of the capsule.

near one pole of the organ, with the sharp-pointed blade of a pair of scissors (Fig. 4499, a) – after which the blades are reversed, and the rounded end is slipped through the opening in the capsule, and, traveling between cortex and

capsule, without cutting the former, splits the capsule toward the opposite pole (v. Fig. 4499, b). Or the splitting of the capsule may be done in the way described in connection with nephropexy (v. Fig. 4502). When the kidney cannot be delivered well out of the wound, the freeing of the capsule is somewhat more difficult (Fig. 4500).

After incising the capsule from pole to pole, its margin, first upon one side and then upon the other, is seized with broad-tipped forceps (v. Fig. 4500, b), carefully drawn away from the kidney, while, simultaneously, a curved, blunt-pointed, elevator or spatula, is inserted between capsule and cortex (v. Fig. 4500, c), and begins the freeing of the capsule from the kidney – until the finger can take its place – and continue the freeing backward toward the hilum.

The entire surface of the major portion of the kidney is thus denuded by stripping off the capsule – but the cortex is nowhere injured. The use of the



Fig. 4501.—Renal Drainage in Association with Kidney Decapsulation; – An oval or square of fibrous capsule is left around the incision, to give support to the sutures closing the wound into the kidney substance.

finger, with the pulp of the finger next to the cortex, accomplishes the denudation best with minimum damage.

When the kidney can be sufficiently exposed to render it possible, the stripped-off capsule is excised with curved, blunt-pointed scissors, near the hilum. If sufficient access for this be impossible, the capsule may be either rolled up upon itself, or everted and tucked around the hilum – or sutured upon itself – so that it will not form re-adhesions with the raw surface of the kidney.

The denuded kidney is sometimes simply dropped back into the wound – but it is probably best to complete the operation as an ordinary nephropexy (v. pp. 382–388) – in which latter case it is necessary to preserve the capsule, or some part of it, for anchorage.

The wound is usually closed without drainage _ in simple cases.

Sometimes nephrostomy is performed in conjunction with capsulectomy _ in those cases where simultaneous drainage of the kidney parenchyma and pelvis may be indicated _ and in these cases, in performing the decapsulation, it is well to leave an area of the resistant fibrous capsule, to be sutured about the drainage-tube _ for the raw surface furnishes poor anchorage for sutures. This technic is shown in Fig. 4501.

Even where simultaneous nephrostomy is not performed, it is probably better to drain the general wound for twenty-four hours _ as there is apt to be some venous hemorrhage into the wound.

NEPHROPEXY—BY EDEBOHLS' TECHNIC

Description.—The fibrous capsule of the kidney, exposed by the lumbar route, is split along the convexity of the organ and peeled back toward the pelvis, on both sides of the kidney, for about half-way _ after which chromic catgut sutures are placed, in special manner, through the detached capsule, and through the muscle boundaries of the lumbar wound. The lumbar wound is then closed _ after which the suspending sutures of the kidney are first tightened and then tied _ thus approximating the partly decapsulated kidney to the raw portions of the lumbar wound.

Position.—The patient lies in the semiprone position, resting obliquely forward, upon the uninvolved side, upon Edebohls' special kidney air-cushion (or other support) _ which, pressing upon the abdomen, generally aids in bringing the kidney prominently into the wound. (It is to be remembered, however, that sometimes the support acts in the reverse direction, especially in marked displacement of the kidney, then pinioning the kidney *below* the support, which can be remedied by temporarily rolling the patient so that he rests entirely upon the sound side, when the displaced kidney will often at once appear in the wound, or may often be then easily brought into the wound.)

The Surgeon usually stands behind the patient in operating upon either kidney _ cutting from above, downward, in exposing the right kidney _ and cutting from below, upward, in exposing the left kidney. In operating upon the left kidney he sometimes stands in front of the patient and, leaning over him, cuts from above downward. The Assistant stands upon the opposite side of the body from the Surgeon.

Landmarks.—Twelfth rib; iliac crest; outer border of the erector spinæ (sacrospinalis); anatomic relations of the kidney (v. p. 293).

Incision.—Straight or slightly oblique incision along the external border of the erector spinæ muscle, passing from the inferior border of the twelfth rib to the iliac crest. Where the space between rib and ilium is very narrow, this incision may begin at the same point, but run more obliquely and reach the ilium further to the outer side of the erector spinæ (Fig. 4405, **d**).

Operation.—Incise skin and fascia. Recognize the latissimus dorsi and separate its fibers in their cleavage line _ beginning the separation over the outer aspect of the erector spinæ and continuing it upward and outward. Or the border of the latissimus may be retracted inward, or even divided transversely, if necessary. Retract the external oblique outward. The sheath of the erector spinæ is not opened. Divide the transversalis fascia, exposing the perirenal fatty areolar tissue. If the iliohypogastric nerve cannot be retracted to one side, it is cut and subsequently sutured with gut after the kidney has been sutured into place. The sheath of the quadratus lumborum is incised from the twelfth rib to the iliac crest, along the anterior surface of its lateral border _ exposing, by the retraction of its incised edges, considerable raw muscle.

The kidney is now freed by blunt dissection from its fatty capsule, aided by clips of curved, blunt scissors, if necesssary _ and is delivered upon the back. The size of the opening in the abdominal parietes may be increased if need be. Dissect away the entire fatty capsule from the proper fibrous capsule of the kidney. Any exploration of the kidney by palpation, *x*-raying, or instrumental means may now be done _ and any measure carried out that may be indicated. At this stage, if the removal of the appendix vermiformis be indicated _ which Edebohls considered to be so in a certain percentage of cases _ the peritoneum is opened external to the kidney and to the outer side of the ascending colon _ part of the ascending colon is drawn out and one of its longitudinal bands is followed down to the cecum and the appendix thus located at the termination of the muscular band _ after which the appendix is delivered into the wound (the kidney having been temporarily replaced) _ and is either inverted entire into the cecum, after ligating the meso-appendix, or excised and the stump treated according to the operator's individual ideas. Following the replacing of the intestines, Edebohls, who also considered that



Fig. 4502.—NEPHROPEXY _ Edebohls' Technic _ I; _ Splitting the kidney capsule _ (two steps of one operation are shown): _ a, The point of the knife knicks the capsule, cutting edge downward; _ b, a grooved director is passed between the kidney and its capsule, in the groove of which a knife is carried, with cutting edge upward, and divides the capsule in the act of traveling toward the opposite pole of the kidney. This is a better technic than that accomplished by scissors and shown in Fig. 4499.

there is an association, in a certain percentage of cases, between nephroptosis and disease of the bile-passages _ explored, by palpation, the gall-bladder, cystic and common ducts, inferior aspect of liver, and the pyloric end of the stomach, through the lumbar wound.

The peritoneal wound is then closed and the kidney again delivered through the lumbar wound, in preparation for anchorage. Where the peritoneum has not been opened the kidney remains delivered, as described, from the time of its first exposure.

Incise the proper capsule of the kidney at the center of its convex border, carefully avoiding entering the kidney substance. Pass a grooved director between the fibrous capsule and kidney proper, first toward the upper pole, and then toward the lower pole, to and half-way around both poles (Fig. 4502). The fibrous capsule is then separated from the kidney by blunt dissection, from the line of incision, peeling it off (as the skin from an orange) on both sides toward the pelvis _ until practically one-half of the kidney is denuded _ the detached portion remaining continuous with the undetached portion,

and turned back upon the latter as the lapel of a coat. (If the proper capsule appear excessive, a portion may be excised.) Four forty-day chromic gut fixation or suspension sutures are now introduced through that portion of the proper capsule which has been detached and reflected _ the passage of the sutures occurring near the line of reflection and being accomplished as shown in Fig. 4503 _ two being placed upon the anterior and two upon the posterior aspect of the kidney, at the center of the upper and lower halves on each side. A straight Hagedorn needle is used _ the suture is carried from within, outward, entirely through the reflected proper capsule, near the line of reflection _ travels transversely to the axis of the kidney, and enters the attached portion of the proper capsule (directly opposite its point of emergence from the detached portion, but slightly lower), and pierces it from without,



Fig. 4503.—Nephropexy _ Edebohls' Technic _ II; _ But placing the fixation or the suspension sutures through the reflected portion of the proper capsule only.

inward, just beyond the line of reflection _ thence the Hagedorn needle travels flatwise, entirely between the proper capsule and the kidney substance (or very superficially within the latter), parallel with and just below the line of reflection for 2 or 3 cm. ($\frac{3}{4}$ or $1\frac{3}{16}$ inch) _ thence emerges through the attached capsule from within outward _ and, traveling transversely to the axis of the kidney, passes through the reflected proper capsule from without, inward, parallel with the companion limb of the suture.

Having placed all four sutures, the kidney, with the eight suture ends hanging free, is returned within the body. Each suture is now passed through the entire lumbar wall from within outward (Fig. 4504) _ either by threading a needle upon each and penetrating the wall from within outward, or by passing a Reverdin needle through the abdominal parietes from without and

drawing the sutures through from within. The four inner sutures will thus pierce the lumbar wall on the inner side of the incision, and at a distance from each other equivalent to the distances apart at which they penetrate the proper capsule _ and will pass through the retracted sheath of the quadratus lumborum near its edge, through the quadratus muscle, and through the erector spinæ. The four outer sutures will pierce the lumbar wall on the outer side of the incision, at the same distance from each other as those of the opposite side, and each at a distance from its companion suture of the opposite side equivalent to the anteroposterior thickness of the kidney _ and will pass

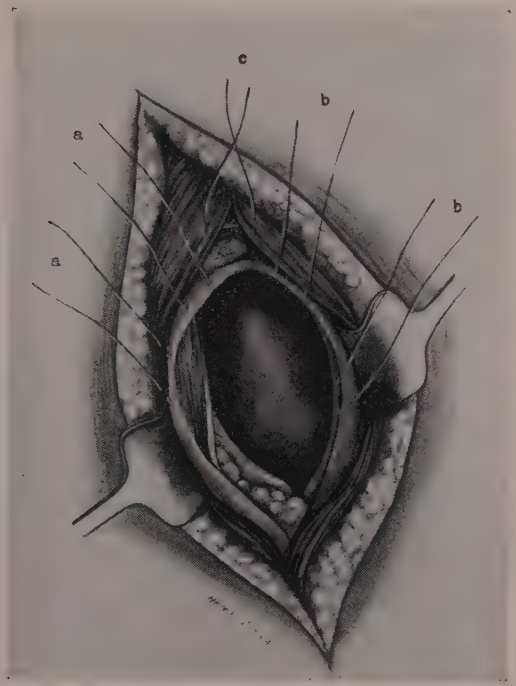


Fig. 4504.—NEPHROPEXY _ Edebohls' Technic _ III; _ The kidney, held by the four still loose fixation sutures, is returned within the lumbar wound. By threading each suture separately or by a Reverdin needle these fixation sutures all passed through the muscles on a level higher than they pass thr ough the capsule are placed in the following manner: _ the four inner sutures, a, a, pass, from below upward, through the quadratus lumborum and its retracted sheath, and through the erector spinæ (sacrospinalis). The four outer sutures, b, b, pass from below upward, through the transversalis fascia and the latissimus dorsi. The opposite margins of the muscle wound are next sutured together _ and then, after making simultaneous traction upon all four sets of sutures, the two limbs of each fixation suture are tied to each other (themselves), drawing the kidney well upward and into the wound. Finally the skin and connective tissue are united with silkworm filament up to the exit of a temporary drain, if one be used.

through the transversalis fascia and the latissimus dorsi muscle. The highest sutures pass through immediately below the last rib. These eight suture ends are, at first, left untied.

The incision in the lumbar wall is now closed, in the cleavage line of the latissimus dorsi, by from four to six deeply buried interrupted sutures of forty-day chromic gut, in such a manner as to turn the raw surface of the quadratus lumborum muscle toward the kidney. This is accomplished by suturing the latissimus dorsi and lumbar fascia, composing the external margin of the wound _ to the latissimus dorsi, the sheath of the erector spinæ, and

the external margin of the incised sheath of the quadratus lumborum, composing the inner margin of the wound (Fig. 4505). The four free suspension or fixation sutures are now drawn taut, thus snugly approximating the decapsulated convex surface of the kidney into contact with the raw substance of the quadratus lumborum from rib to ilium _ and are then tied (Fig. 4505). The skin and fascia are then closed in the line of the original incision with a subcuticular suture _ and a broad lumbar dressing applied.

Comments.—The majority of Surgeons do not apparently penetrate any portion of the kidney substance by the suspending sutures _ while some do. It is the Writer's understanding that only the detached portion of the proper capsule is pierced by the sutures in the original technic _ as is shown in Fig. 4503. This qualifying statement is made in the absence of access to the des-



Fig. 4505.—Nephropexy _ Edebohls' Operation _ IV; _ Anchoring kidney and closing lumbar wound _ the skin wound is shown retracted, and the kidney has been returned within abdominal wound: A, A, Two upper buried fixation sutures untied. The two lower fixation sutures are tied. B, Untied buried suture uniting lips of lumbar wound in cleavage line of latissimus dorsi. Similar sutures below are tied. (Modified from Edebohls.)

cription of the original operation. The Writer has employed the technic described in the body of the article a number of times, with most satisfactory results _ always penetrating a superficial portion of kidney substance at the lowest aspect of each of the four suspending sutures, along the finely dotted lines in Fig. 4503. Theoretically, the avoidance of penetration of kidney tissue would be better _ and, probably, practically.

In the final disposition of the parts, prior to closing the wound, the reflected portion of the capsule is pressed down toward the hilum of the kidney, so that as much of its raw surface as possible, held spread out, will come into contact with opposite raw surfaces for adhesions.

Some Surgeons keep patients in bed for four or five weeks after kidney fixations _ and a rather long horizontal convalescence is undoubtedly desirable.

The Writer has practised the habit of having patients lie for two weeks literally upon their backs _ or, at most, resting themselves by turning to the side of

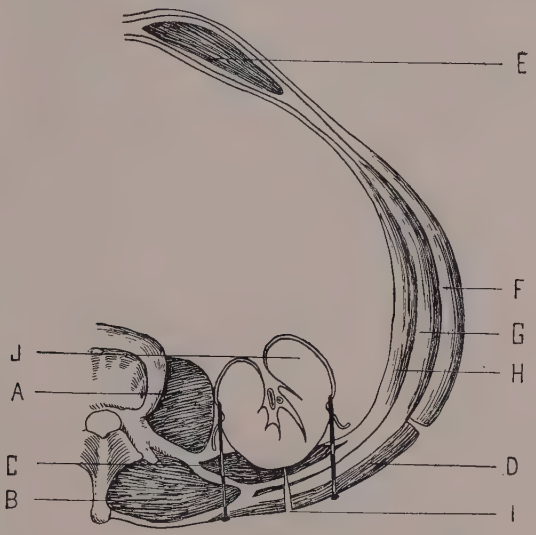


Fig. 4506.—Nephropexy _ Edebohls' Operation _ V; _ Cross-section of region of operation: A, Psoas magnus; _ B, erector spinæ; _ C, quadratus lumborum; _ D, latissimus dorsi; _ E, rectus abdominis; _ F, external oblique; _ G, internal oblique; _ H, transversalis; _ I, lumbar incision exposing kidney; _ J, the decapsulated convexity of kidney is shown approximated to raw substance of quadratus lumborum by the fixation sutures seen passing through both the detached and adherent portions of proper kidney capsule. (Modified from Edebohls.)

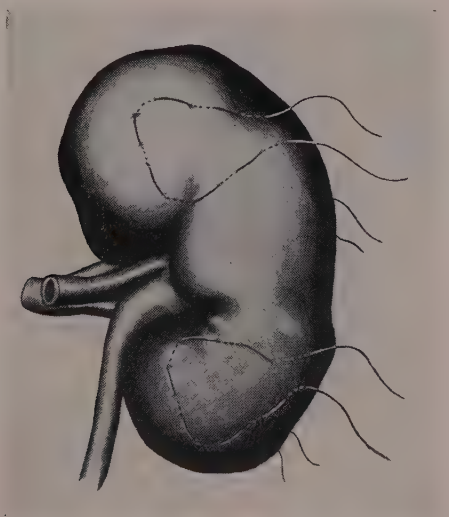


Fig. 4507.—The Modified Broedel Triangular Kidney Fixation Sutures; _ The subcapsular kidney fixation sutures placed, and ready to be carried through the muscles and aponeuroses. Two sutures are here shown on each side of the kidney, to be used as in Edebohls' fixation.

the fixed kidney (but not to the opposite side) _ and a third week, still in bed, but with greater freedom.

As there is apt to be considerable venous oozing following these operations – probably more when the kidney substance proper has been included in the sutures which suspend the organ, the Writer has found a twenty-four-hour drain helpful in freeing the wound of this accumulation – the drain being carried down to the kidney between one or two placed, but untied stitches – which are tied when the drain is withdrawn.

It has been proposed, instead of splitting and everting the kidney capsule, to suspend the kidney by means of four of Broedel's triangular, subcapsular stitches – otherwise carrying out the Edebohls technic. These stitches, applied to the kidney, are seen in Fig. 4507 – and are described under Kelly's nephropexy – (like which the operation then practically becomes).

NEPHROPEXY—BY KELLY'S TECHNIC

Description.—The kidney is exposed by the lumbar route – and is suspended by three silk sutures of special type – all of which pass through the

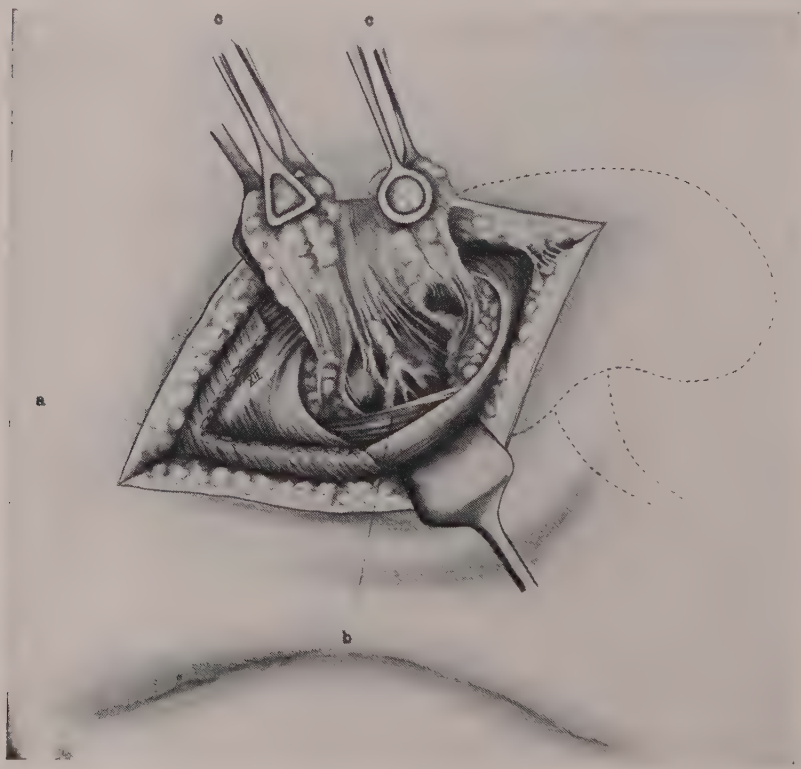


Fig. 4508.—NEPHROPEXY – Kelly's Technic – I: – a, Incised latissimus dorsi, to increase room; – b, exposed quadratus lumborum, seen through its incised sheath; – c, c, forceps grasping the fatty areolar perinephritic tissue. The upper pole of the prolapsed kidney is seen in the wound – and the lower pole n dotted outline. (Figs. 4508–4511 modified from Kelly.)

posterior aspect of the kidney capsule, and through the superficial part of the underlying kidney substance – after which the uppermost suture is tied above the twelfth rib, and the other two sutures are carried through the border of the quadratus lumborum exposed along the inner (median) side of the

wound. The lumbar wound is closed by layer suturing _ without drainage. The kidney is finally held in place by adhesions between it and abdominal parietes.

Preparation.—As for Exposure of the Kidney, in General.

Position.—The patient lies in the semiprone position, with face directed toward the side of the involved kidney _ and with a partially inflated Edebohls' cushion beneath the opposite lumbar region, so placed as to round out and increase the space between the twelfth rib and iliac crest, on the side of the involved kidney.

Landmarks.—Twelfth rib; iliac crest; superior lumbar trigone.

Incision.—The incision begins over the twelfth rib, just above the lumbar trigone (the area of lessened resistance, in the angle between the twelfth rib and the spinal column) _ and passes downward and outward, at an approximate angle of 45 degrees, for a distance of about 6 cm. ($2\frac{3}{8}$ inches) _ and this may be subsequently continued in the direction of the iliac crest as far as necessary.

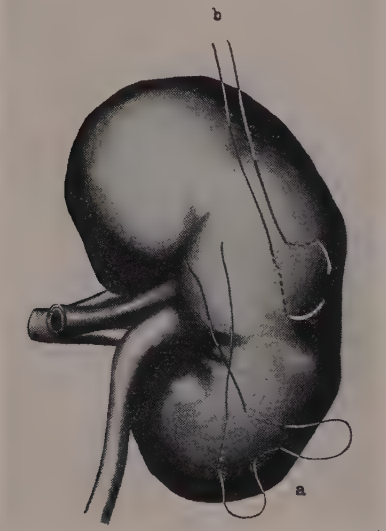


Fig. 4509.—The Broedel Triangular Subcapsular Kidney Fixation Sutures: _ a, The details of the suture; _ b, the suture drawn into position. The suture nearer the upper pole is not here shown.

Operation.—The incision passes through skin and superficial connective tissue, down to the superior lumbar trigone, between the latissimus dorsi and the external oblique. Sometimes, especially when the muscles are not particularly well developed, they may be sufficiently retracted. At other times the fibers of the latissimus dorsi may be split _ and, again, it may be necessary to cut them transversely _ as shown in Fig. 4508 _ which brings the lumbar fascia into the field.

The muscles are retracted to each side of the field of operation, and the lumbar fascia is opened _ by boring a closed clamp through the fibrous tissue and then opening its blades. (Or the lumbar fascia may be opened by a carefully placed incision.) Whether punctured or incised, the opening in the lumbar aponeurosis is increased to the desired extent largely by digital stretching. The opening is freed, internally, up to the outer aspect of the quadratus lumborum _ while externally the posterior border of the external

oblique may be retracted well forward. The fat overlying the kidney is broken through by blunt dissection – and the thin, fibrous capsule of Gerota – when the lighter, softer fat immediately around the kidney comes into the field.

If there be any question as to the freedom of the kidney, at this stage of the operation, the patient should be shifted somewhat upon the air cushion – (which may either have pushed the kidney upward, under the ribs – or pinioned it downward, in the pelvis) – when the kidney will usually come readily into the field. The fatty capsule of the kidney is now grasped by a half-dozen clamps (two or three are apt to tear out) – and which are henceforth used as

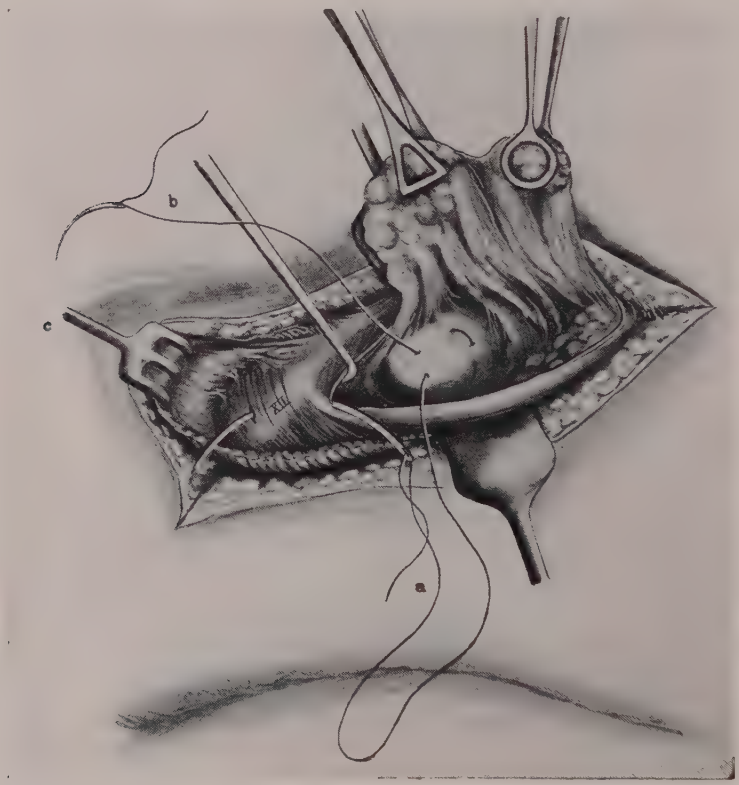


Fig. 4510.—The Same – II; – The kidney has been drawn into the wound by traction upon its fatty areolar capsule by means of forceps: **a,** The triangular suspension suture is carried through the kidney capsule upon a delicate needle, and then threaded upon a coarser one, to be carried over the twelfth rib; – **c,** retraction of the upper part of the lattissimus dorsi to expose the rib.

tractors, for drawing, indirectly, the kidney into position for manipulation – which technic is shown in the picture last quoted. While the fatty areolar capsule is thus held by clamps, the index-finger frees it from the proper capsule of the kidney, while the kidney still lies within the lumbar wound – it not being a necessary part of the present technic to deliver the kidney outside of the wound, under average circumstances. The first lumbar nerve, exposed in the lower inner aspect of the wound, to the outer border of the quadratus lumborum, is guarded.

Three suspension sutures are used – of strong, fine, white silk, carried upon a small, curved French needle (the needle carrying the first stitch which goes

over the rib is of larger curve). The sutures are of the Broedel triangular type _ and do not pass to a greater depth than 1 cm. ($\frac{7}{16}$ inch) into the kidney parenchyma, which is not deep enough to wound the calices. The type of of suture is shown in Fig. 4509. For the three sutures as used in the Kelly technic v. Figs. 4509 and 4511.

As explained, the first suture (which is placed in the posterior aspect of the kidney nearer the upper pole), which goes around the twelfth rib, is carried by a needle of larger curve underneath the rib _ the under aspect of which is carefully from pleura, in case of its presence _ and the upper surface of which is freed, in the overlying connective-tissue plane, for the exit of the needle. The needle is carefully conducted beneath the rib, while guided by the left index-finger (Fig. 4510). The opposite end of the first stitch is then threaded onto a coarser needle of larger curve, and similarly carried through the wall,

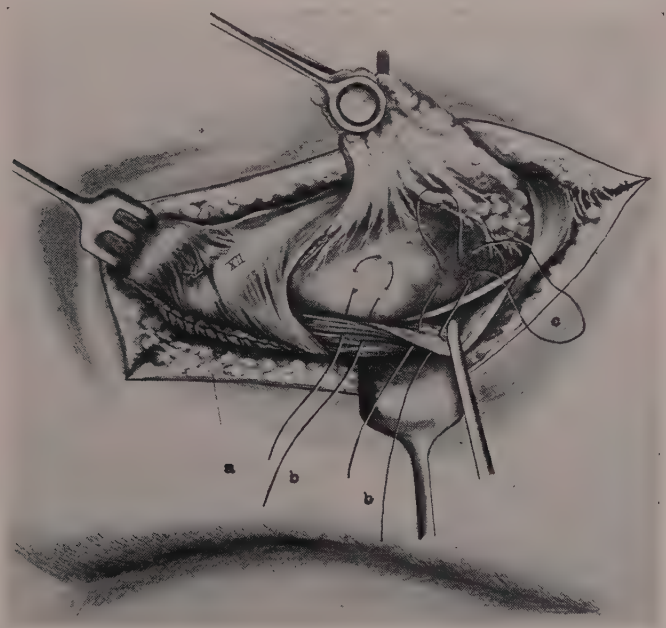


Fig. 4511.—The Same _ III: _ a, The uppermost fixation suture has been tied above the twelfth rib; _ b, b, second and third fixation sutures piercing the quadratus lumborum; _ b, c, one of the fixation sutures shown in detail. The first lumbar nerve is seen passing downward and forward.

above the last rib, and tied to the other end of the first suture (Fig. 4511). (All ends of the three sutures, after they have been placed in the kidney with a delicate needle, could be more readily carried into position through the muscle wall by means of a Reverdin needle. Apparently, passing both limbs of the first suture above the rib, rather than one limb above, and the other below, secures a somewhat higher anchorage for the upper pole of the kidney.) The second suspending suture is placed in the middle of the posterior surface of the kidney _ and the third suspending suture, nearer the lower pole, upon the same surface. The free ends of the middle and lower sutures are carried through the outer border of the quadratus lumborum muscle. In tying all stitches the kidney should be lifted upward by the hand, toward the site of anchorage, during the tying, which should be carefully done, and without force and too great tension. It is during the passing and tying of the second

and third suspension sutures to the quadratus lumborum that the first lumbar nerve must be particularly guarded. The tightening of the sutures, as the kidney becomes anchored, serves as means of hemostasis.

If the fatty capsule be excessive, part of it is excised _ ligating bleeding vessels with fine catgut. The portion of this capsule retained _ whether all of it or part of it _ is anchored to the quadratus lumborum by sutures.

Finally, the lumbar wound is closed by layer suturing. If any of the muscles have been cut, they are repaired by suture with catgut. The quadratus is brought over the external oblique, to restore the structure of the lumbar trigone. Connective tissue is brought together with catgut _ and the skin is closed with fine, subcutaneous catgut suturing.

Following the operation the patient is not allowed to turn upon the side opposite the fixed kidney for two weeks.

Comments.—The kidney should not be penetrated by the sutures far enough to traverse the calices, as renal fistula might result.

Kelly, in his earlier operations, passed sutures through the kidney _ sometimes removing them subsequently to operation.

NEPHROPEXY—BY ALBARRAN'S TECHNIC

Description.—The kidney is exposed by an oblique lumbar incision _ brought into the wound, and its fibrous capsule (proper capsule) split from pole to pole, and stripped backward more than half-way to the hilum. The two halves of the capsule are then split into quarters _ their ends ligated _ and then anchored to the structures of the wound _ the two upper to the last rib _ and the two lower into the muscular and aponeurotic boundaries of the wound. Temporary drainage is established _ and the wound closed, up to the drain, by buried and superficial sutures.

Preparation.—As for Exposure of the Kidney, in General.

Position.—The patient lies in the semiprone posture _ resting upon the sound side, with the chest tilted forward _ and supported by a firm cushion in the interval between the costal arch and the iliac crest, so as to round out the opposite bony boundaries of the renal region.

Landmarks.—Twelfth rib; iliac crest; outer border of the sacrospinalis (erector spinæ).

Incision.—Begins over the twelfth rib, at the outer border of the sacrospinalis _ and passes downward and forward in the direction of a point about a fingerbreadth above the anterior superior iliac spine. At first a limited incision is made _ which later may be extended in either direction.

Operation.—The kidney is exposed and delivered into the wound in the usual manner described for the exposure of the kidney by the lumbar route. All of the perirenal fatty areolar capsule is freed from the proper kidney capsule _ so that the naked fibrous capsule will come into direct contact with the abdominal wall in the subsequent steps of anchorage. When the kidney, thus freed, is brought out of the wound (which the free pedicle of a movable kidney usually makes easy), and before proceeding with the operation of fixation, thorough examination should be made of kidney, pelvis, upper ureter, pedicle, and environment, for possible pathologic conditions.

When these objects have been accomplished, and while the kidney is steadied by an Assistant, the fibrous capsule is split over the convexity of the organ, from pole to pole, in the manner described and pictured in the Edebohls technic (v. p. 383 and Fig. 4502) _ and sparing the underlying kidney from section. The split fibrous capsule is carefully caught with broad forceps and gently peeled from the kidney, aided by blunt dissection with the gloved finger,

until it is freed on both sides nearly back to the hilum. Then, while the corner of each flap is held by clamp forceps, each half of the freed capsule is split down the center with scissors (Fig. 4512), thus making four equal flaps of the four quarters. While each of the four capsular flaps are held by clamps, the Surgeon ligates each flap with No. 2 chromic catgut _ tying the flaps near the hilum _ (in the illustration last quoted the fibrous flaps are ligated too near their free ends). The clamps are now shifted from the fibrous flaps to the ligatures which should bind them nearer their bases. The kidney is then replaced within the abdomen to its normal site _ especially seeing that no fatty tissue intervenes between the kidney and the structures into contact with which it is to be brought in the process of anchorage _ particularly the freed quadratus lumborum, the last rib, and adjacent diaphragm. Albarran



Fig. 4512.—NEPHROPEXY _ Albarran's Technic _ I; _ The kidney capsule is split axially and turned outward on both sides. Each half is then cut through toward the pelvis of the kidney into halves, making four quarters. Each quarter is then bunched together by a ligature around its free end _ thus forming a "hammock" for the kidney. (The ligatures should be tied nearer the hilum than here represented.)

states that it is essential to the success of the operation that no fat intervene between the kidney and the structures to which it is intended it should become adherent.

By means of either a Reverdin needle, or an ordinary, curved needle, one of the ligatures of, first, the anterior upper, and then of the posterior upper flap is conducted around the last rib, from below upward, the needle closely hugging the anterior surface of the rib, and piercing the structures of the eleventh intercostal space. The kidney is then carefully pushed up by the hand into its usual position behind the last rib, and while the kidney is thus supported, the companion ligature of each of the upper flaps is brought up and tied with its mate _ the ends of the posterior ligature being tied first. These maneuvers are shown at **a** and **b**, Fig. 4513.

By plain or Reverdin needle the anterior and posterior lower capsular flaps are anchored _ one ligature of the posterior inferior flap being carried through the exposed border of the quadratus lumborum, and tied to its mate (carefully avoiding the iliohypogastric nerve) _ and one ligature (v. Fig. 4513, **d**) of the anterior inferior flap being carried through the anterior muscular margin of the lumbar wound, and tied to its mate (v. Fig. 4513, **c**).

Having assured one's self of the hemostasis of the wound _ and inserting a twenty-four-hour drain down to the kidney _ the lumbar wound is closed by buried chromic catgut layer suturing, of divided muscle tissue and of aponeuroses _ except the portions of the quadratus lumborum and transversalis which are included in the kidney anchorage and which are included in the ends of the ligatures of the capsular flaps which have been carried through them.

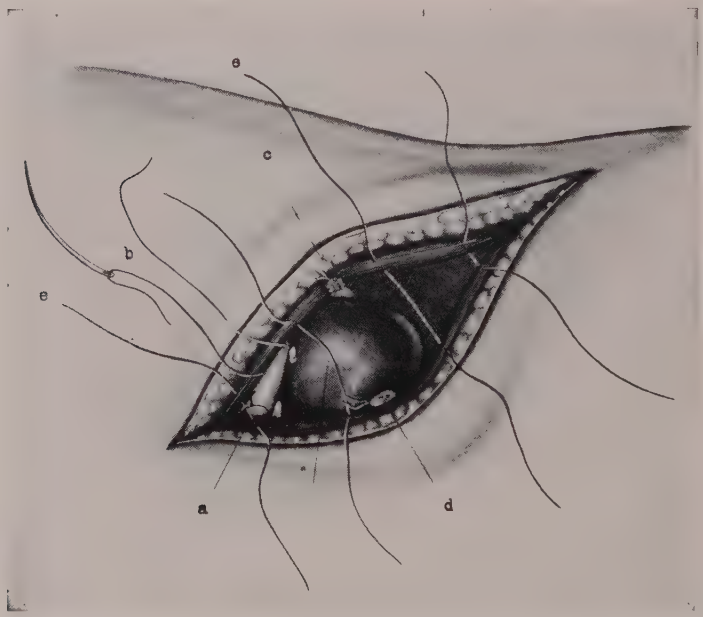


Fig. 4513.—The Same _ II; _ The ligatures bunching the two upper quarters of the capsule, **a, b,** are carried around and anchored to the twelfth rib. The two lower bunched quarters, **c, d,** are anchored into the muscle portion of the opposite wound surfaces. The muscle margins are then brought together by sutures, **e, e,** _ and then the fascia and skin.

Comments.—It would seem that the four tails into which the two halves of the freed capsule are cut might be anchored in a more satisfactory manner than by bunching them with a ligature, and then tying the bunched ends in contact with structures around which the ligatures have been drawn, or which they have pierced. It would seem that the two upper flaps might be split again, and be sutured together over the last rib, lying more smoothly over it, one in front and one behind, _ and that the two lower flaps might be sutured, smoothed out flat, to the structures of the two sides of the lower part of the lumbar wound. In this way broader, more even, and smoother surfaces would be offered for union with adjacent structures _ rather than irregularly puckered ones. The union of the denuded kidney to adjoining structures also greatly aids in the suspension of the kidney.

OTHER FORMS OF NEPHROPEXY

Many variations in the technic of nephropexy are employed by various Surgeons _ the salient features of some of which will be here described _ in addition to the methods whose details have been given at greater length.

Tuffier's Method of Nephropexy.—The proper fibrous capsule of the kidney is axially incised, along its midposterior aspect, throughout the greater part, or its extent. To this is added a cross-cut, at the upper and lower ends of the axial cut, and at right angles. Two trap-door flaps of kidney capsule are thus outlined _ and these are carefully peeled from the underlying kidney substance _ hinging away from the middle line of the kidney on either side. By means of a Reverdin needle (or curved needle, in holder), from six to eight suspending sutures of chromic catgut are placed _ passing through both the reflected and unreflected portion of the capsule, and through the superficial part of the underlying kidney substance (Fig. 4514). Then the outlying limb of each pair of sutures is carried through the muscular and aponeurotic boundary of the wound, upon its own side _ and tied to its corresponding limb. The stitches are tied as buried sutures, simultaneously drawing the kidney up to the lumbar fascia, posterior abdominal wall, and borders of the wound _ and at the same time approximating the deeper parts of the wound. The muscle margins of the wound are then, additionally, brought together by buried sutures _ and the skin closed _ with or without temporary drainage.

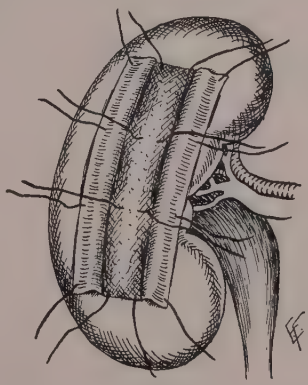


Fig. 4514.—Tuffier's Nephropexy; _ Sutures are seen penetrating kidney substance and split capsule, which latter has been turned back on either side. The outer limbs of the sutures are ready to be carried through the sides of the abdominal wound, to which the kidney will be approximated by tightening the sutures.

Nephropexy by Simple Suturing.—Several methods of simple suturing of the kidney into the lumbar wound, without any form of decapsulation, have been employed _ though the resulting union is not supposed to be so secure. After removing the perirenal fat from the portion of the surface of the kidney corresponding with the proper capsule of the kidney which is to be utilized in the suspension, chromic catgut sutures are passed through each of the margins of the wound, and through the underlying fibrous capsule and superficial kidney substance (Fig. 4515) _ very much as is done in the Tuffier technic, except that the fibrous capsule is not split _ after which these buried sutures are tied _ and the margins of the muscles may be additionally sutured together.

Another method of placing the sutures through the margins of the wound and through the unopened fibrous capsule of the kidney _ together with carrying the two highest sets of sutures around the last rib _ is shown in Fig. 4516.

Guiteras' Method of Nephropexy.—The fibrous capsule of the kidney is split from pole to pole along the convexity of the organ _ after which the inner half only of the proper capsule _ the half toward the spine _ is peeled back from the kidney _ and tucked in under the raw muscular and aponeurotic structures of the inner aspect of the lumbar wound, by means of a probe or grooved director. Mattress-sutures are then placed in the manner show in Fig. 4517 _ taking a good hold upon the undetached fibrous capsule of the

opposite side of the kidney, including a superficial portion of the kidney substance. The opposite ends of the sutures are then carried through the

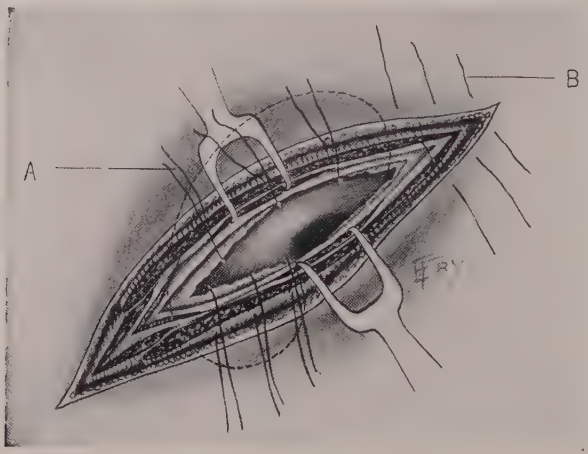


Fig. 4515.—Nephropexy by Simple Suturing: – A, Sutures passing through lower portion of lips of wound, perirenal fatty areolar tissue, and kidney substance, ready to bind kidney to and into lower plane of wound; – B, sutures passing through skin and upper portion of lips of wound.



Fig. 4516.—Nephropexy by Simple Suturing; – The two uppermost kidney sutures are carried around the twelfth rib, the remaining kidney sutures being carried through the lumbar aponeuroses and muscles. The overlying muscles and aponeuroses are then drawn together by sutures passing through their substance. (Modified from Duval.)

muscular and aponeurotic margins of the inner lip of the lumbar wound and tied, thus approximating the raw portion of both kidney and the detached half of the fibrous capsule to the raw tissues of the inner aspect of the wound.

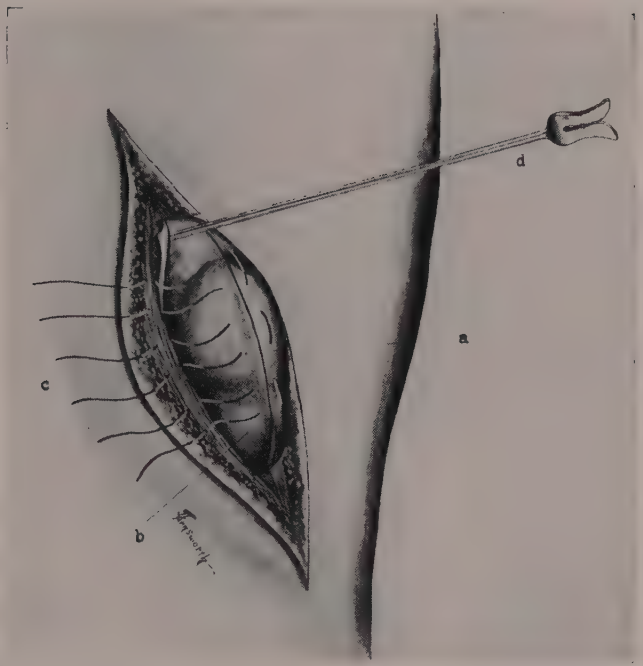


Fig. 4517.—Nephropexy – Guiteras' Technic; – One-half of the capsule has been peeled from the kidney, rolled outward, and tucked down by a grooved director, **d**, so that its raw surface is toward the wound. Mattress-sutures, **c**, are so placed through the kidney substance, capsule, and the cut, or separated muscles of one lip of the wound, that, when tightened and tied, the raw aspect of the kidney is approximated to the corresponding wall of the wound.

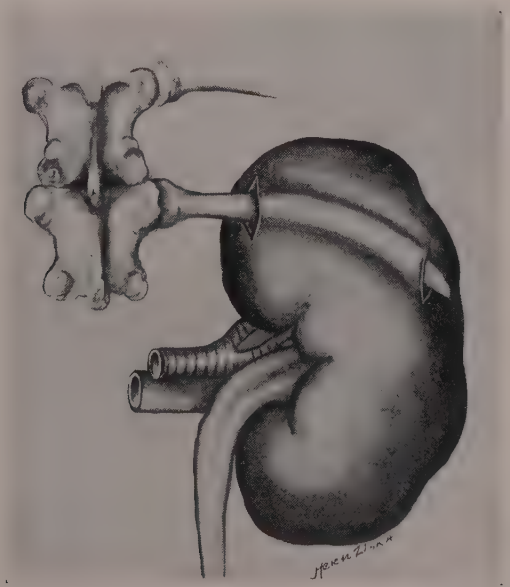


Fig. 4518.—Nephropexy – Narath's First Method – in which the twelfth rib, freed of its soft parts, is made to pass between the kidney substance and the capsule – in those cases where the rib is short enough and the kidney free enough for the maneuver.

Narath's Nephropexy.—The chief feature of this procedure is the manner of utilizing the last rib for supporting the displaced kidney. Narath adapted his technic to two sets of conditions:—When the last rib is short enough it is freed of its soft parts, and its end is then carried through two small incisions, upon about the same level, made upon the posterior aspect of the upper pole of the kidney—passing between the fibrous capsule and the kidney substance—"spitting" the kidney, as it were (Fig. 4518). It is necessary that the rib should be short enough, or the kidney pedicle free enough, or both, to allow of the kidney being laterally displaced far enough to enable the tip of the last rib to enter the incision nearer the inner border of the kidney, and then traverse the path for it, previously tunneled by a blunt dissector.

Where, on the other hand, the last rib is too long, or the kidney pedicle of the displaced kidney too short, then, instead of adopting the above method, two small axially placed incisions are made through the fibrous capsule near

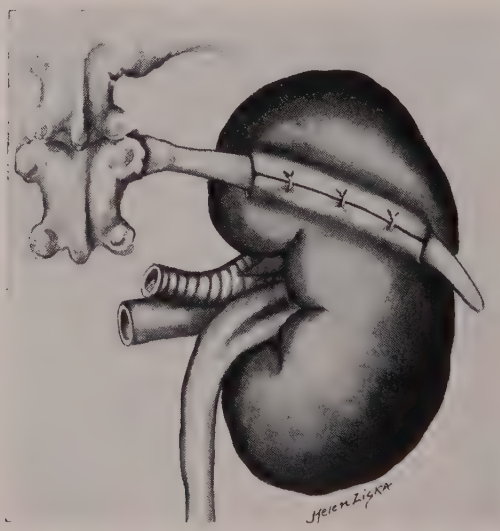


Fig. 4519.—Nephropexy—Narath's Second Method;—Two short axial and an obliquely transverse incision are planned for two narrow flaps of the posterior kidney capsule—which are then sutured together over the twelfth rib—with less displacement of the parts than in Narath's method just described.

the inner and outer margins of the midregion of the posterior surface of the upper pole of the kidney—and the middle of these two lateral, axial incisions is joined by an obliquely transverse incision (corresponding with the trajectory of the last rib). Two small trap-door flaps are then turned back—the posterior surface of the kidney brought into contact with the last rib—and the two flaps brought backward, over the upper and lower borders of the rib—and sutured (Fig. 4519).

Vogel's Nephropexy.—In this technic the displaced kidney is suspended from the last rib—suspender fashion—in one of two ways.

In Vogel's first method two strips of the fibrous capsule are outlined and raised from the posterior surface of the kidney (Fig. 4520, **b** and **b**). These two flaps are entirely freed—and the last rib is freed of its soft parts at the site through which the flaps will pass—after which the two capsular flaps are passed over the last rib, from in front, backward, while the kidney is held up in position by the fingers—and the flaps are then sutured in such a manner

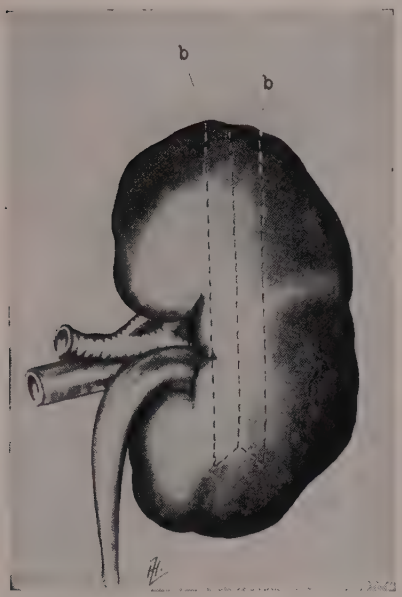


Fig. 4520.—NEPHROPEXY _ Vogel's First Method _ I; _ The outline of the capsular flaps to be raised from the capsule of the posterior surface of the kidney are shown in dotted lines. (Figs. 4520–4522 modified from Kuemmel.)

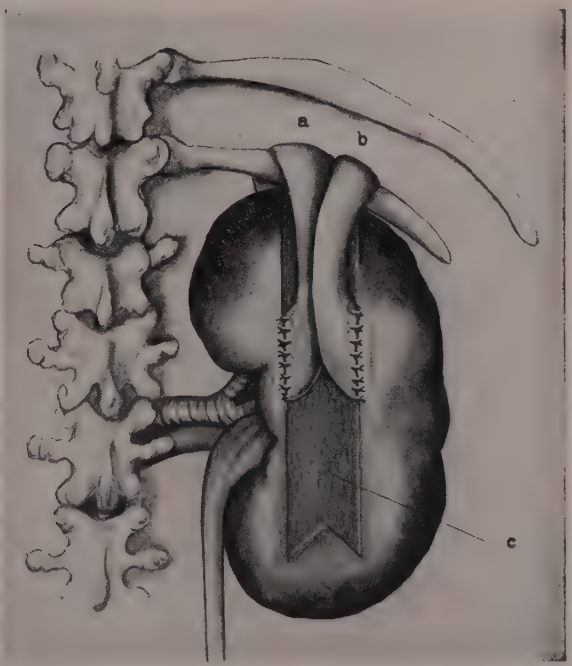


Fig. 4521.—The Same _ II; _ The two capsular flaps are freed from the posterior surface of the kidney and carried over the twelfth rib (through a previously tunneled way) _ and are then sutured as far down upon the posterior kidney surface as they will reach, raw surface to raw surface, to the margins of the undetached portion of the capsule. The kidney is thus suspended from the twelfth rib.

that their ends are applied to the sides of the still attached portions of the capsule, along the line of capsular section – the site of suturing being higher than the site from which the ends of the flaps were detached – but the nearer they are sutured back to their original site, the higher up will the kidney be lifted by the suspenders (Fig. 4521).

In Vogel's second method two parallel flaps, corresponding with those just described, are raised – but, in this case, from the anterior surface of the kidney and from its upper pole. These two flaps are reverted backward upon themselves – and are carried over the last rib, which has been cleared of soft parts at the site of their passage – and are then sutured, capsule to capsule,

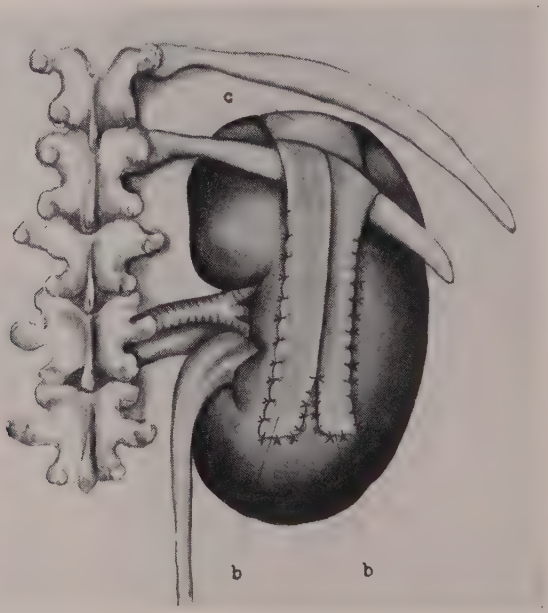


Fig. 4522.—Nephropexy – Vogel's Second Method; – In this form of the Vogel procedure the capsular flaps are raised from the anterior surface of the kidney – reversed and carried over the twelfth rib – and sutured to the posterior surface of the kidney. The kidney is thus both suspended and drawn up in front of the twelfth rib. (Modified from Kuemmel.)

to the posterior surface of the kidney, while the kidney is being held upward in position, in front of the last rib (Fig. 4522) – the kidney being raised in correspondence with the extent to which the freeing of the flaps has been carried backward, and the level at which they have been sutured.

PARTIAL EXCISION OF THE KIDNEY FOR TUMORS

Tumors of the Bladder.—These are divided, according to Geraghty, into the following groups:

(*a*) Primary Tumors of the Kidney Parenchyma:

Malignant:

Hypernephroma.

Carcinoma.

Adenoma, papillary cystadenoma, and exceptional types.

Embryonic tumors:
Round-cell sarcoma.
Spindle-cell sarcoma.
Adenosarcoma.
Mixed tumors.
Teratomata.
Benign:
Adenoma.
Fibroma.
Lipoma.
Angioma.
(*b*) Tumors of the Renal Pelvis:
Malignant:
Papilloma.
Squamous-cell carcinoma.
Embryonal tumors.
Benign:
Papilloma.
(*c*) Tumors of the Capsule.
(*d*) Tumors of the Adrenal Gland.

The tumor most commonly encountered in the adult is the hypernephroma. Of the tumors found in children, Geraghty states that the large proportion of sarcomata of earlier statistics is in contrast with later compilations made since the embryonal origin of tumors occurring in early life has been recognized.

Partial Excision of the Kidney for Tumor, in General.—Under favorable circumstances benign tumors of the kidney of reasonable size may undoubtedly be removed _ and should be removed _ without the sacrifice of the entire kidney. At the same time occasions for this practice must be unusual. Albarran stated that he had only performed a single partial nephrectomy (the technic of which is shown in Fig. 4512) _ writing, "The anatomic characters of the different renal tumors do not allow us to know, during the operation, whether the tumor be benign or malignant _ as a result of which partial nephrectomy for neoplasms should be an exceptional operation." And when operation is undertaken he advises that the tumor be excised with a wide margin, in the event of malignancy, as infiltration generally extends much further than can be detected at the time of operation. Part of a lacerated kidney is also sometimes excised.

Geraghty is even more sweeping in his condemnation of partial nephrectomy; _ he writes, that while resection of the kidney has been suggested and carried out in selected cases, study of the pathology of these cases plainly shows how impossible it is to determine, from inspection, the extent to which the kidney may be involved _ concluding with, "For this reason it is a poor operation, and should never be performed."

Partial Nephrectomy.—The kidney is exposed in the usual way _ generally by the lumbar route _ freed of its fatty capsule _ and delivered into the wound _ with its pedicle so accessible that it may be controlled by clamp pressure to prevent hemorrhage _ and this control should be maintained throughout the operation. In some cases a small tumor may be excised by elliptic excision, placed, preferably, in the long axis of the kidney, when this is possible. In other instances the tumor is best removed by the excision of a V-shaped or wedge-shaped piece of the kidney _ as shown in Fig. 4523, **a**. Owing often to the uncertainty of the nature of the tumor being removed, a very liberal, free margin of normal kidney tissue should be sacrificed _ to make sure of excising all areas of infiltration. Following the completion of the excision any vis-

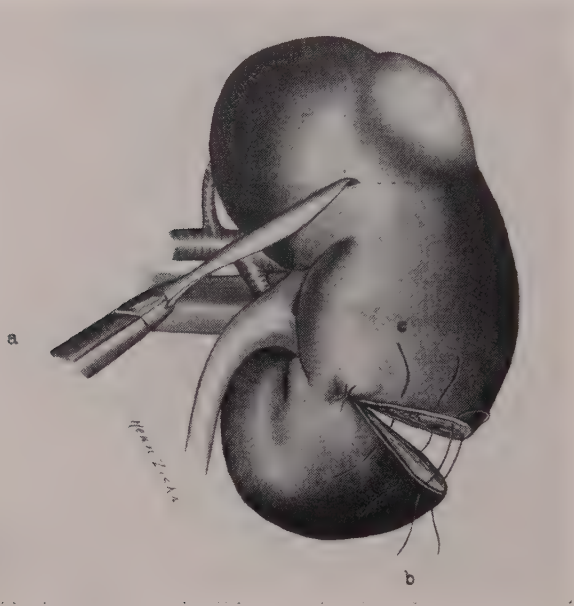


Fig. 4523.—Partial Nephrectomy; – A wedge-shaped excision of a tumor mass by transfixion is shown near one pole of the kidney, – and the suturing of the kidney substance, resulting from such an excision, near the opposite pole, where penetrating and superficial sutures are shown.

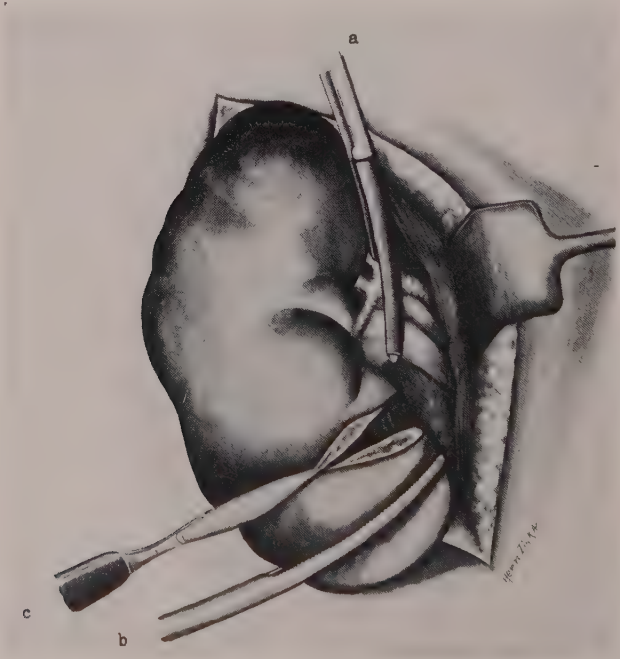


Fig. 4524.—Partial Nephrectomy: – a, Clamp temporarily controlling the pedicle; – b, forceps grasping the lower pole of the kidney to be removed; – c, knife severing the lower quarter of the kidney. The divided end of the retained portion of the kidney will be closed by suture.

ible vessels which bleed are taken up and tied with fine catgut _ after which the opposite surfaces of the kidney are brought together by sutures. Some of the sutures may penetrate the entire kidney (v. Fig. 4523, **c**) _ though deeply placed mattress-sutures (v. Fig. 4523, **b**) are generally better _ while the margins may be brought together, at intervals, by interrupted sutures which take a good hold upon the resistant capsule.

Where the pole of a kidney is to be excised the pedicle is safely clamped, and the portion of the kidney distal to the line of section is also held by a clamp _ after which the involved part of the kidney is cut away from the bulk of the kidney _ as seen in Fig. 4524. The subsequent suturing is easier, however, if the pole of the kidney be removed by V-shaped excision. All bleeding vessels which may be isolated and clamped are tied. The opposite surfaces of the kidney are brought together by deep mattress-sutures _ reinforced by interrupted marginal sutures.

Temporary drainage is instituted wherever likelihood of postoperative oozing is present _ and the wound closed, up to the drain.

LUMBAR NEPHRECTOMY

Description.—Excision of the kidney by the lumbar route. The general indications and other bearings of the procedure are briefly mentioned under Total Nephrectomy, in General, p. 406.

This is the usual method of approach in excising the kidney _ but if the ordinary lumbar incision, as usually practised, does not give sufficient room for manipulation, in the complications of the special case, the lumbar incision may be extended at either end _ especially in its lower part _ either continuously on downward, more or less parallel with Poupart's ligament _ or the incision may be angulated, at either end, toward the median line.

Preparation _ Position _ Landmarks _ Incision.—As for exposure of the kidney by the lumbar route (v. p. 302).

Operation.—The incision should be sufficiently long or modified to admit freeing the kidney without damaging its pedicle, especially if complicated by adhesions _ and should be delivered into the wound without too great tension upon the pedicle, particularly the vascular structures of its pedicle. The details of exposing and of delivering the kidney are the same as those described under the technic of the lumbar exposure (v. p. 302) _ and, up to the accomplishment of the delivery of the organ (freed of its perirenal fatty tissue), either within or without the wound, differ in no respect from the procedure there described _ unless it be from the complicating features of the special case, which naturally are especially apt to be present in cases where the kidney comes up for excision. Sometimes the fatty perirenal capsule is more adherent to its outer surroundings than it is to the kidney around which it lies _ so that once the plane between perirenal and proper capsule is entered, the kidney may often be stripped very readily. Conditions are made easier, in the subsequent steps, if both poles, the pelvis, and the pedicle can be freed _ and the structures of the pedicle be brought within fair reach.

The method of dealing with the pedicle, the first and most important step after exposing the kidney, will differ according to circumstances. It is more surgical to ligate individually the three structures composing the pedicle _ renal artery, vein, and ureter. The artery should be ligated first of the vascular structures so that the blood-supply will be cut off and the kidney contain less blood _ and the vein next. Sometimes both artery and vein are included in the one ligature. If the kidney and pedicle are sufficiently free to admit of being drawn well into the wound, no great difficulty ought to be experienced in slip-

ping a finger behind the structures of the pedicle, and then separately carry a ligature around each one of them separately _ as shown in Fig. 4525. In cases where it is difficult to deliver the kidney so that the structures of the pedicle can be isolated, one may begin by tilting the lower pole of the kidney outward with the index-finger _ feeling for the tautened pelvis and ureter, under and below the lower pole, as the pelvis stretches out into the ureter, which then runs forward toward the peritoneum. Guided by a finger, a double ligature is carried around the ureter upon an aneurysm needle. It is better

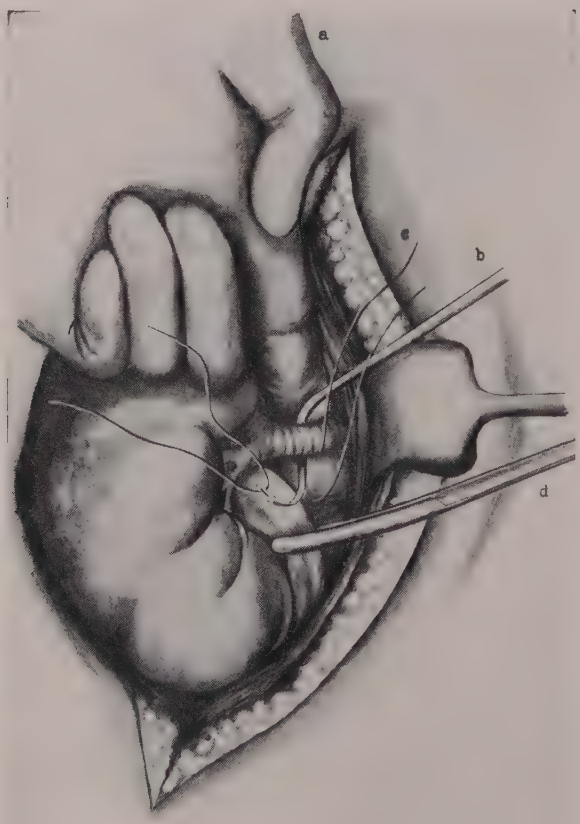


Fig. 4525.—Lumbar Nephrectomy _ Placing Double Ligatures Upon the Structures of the Pedicle Prior to Their Division: _ a, Finger introduced underneath the pedicle, to render its constituents prominent; _ b, ligation of renal artery; _ c, of renal vein; _ d, clamping the ureter, and bringing it into the field.

that all three structures of the pedicle should be both separately tied _ and doubly tied _ with division between the double ligatures. In the majority of cases it is better to first clamp the pedicle proximally to the site of intended ligatures. This safeguards the situation against possible accident during the act of ligation. In some instances, in difficult cases, it may be found more convenient to doubly clamp each structure with two small clamps _ then divide the three structures between these clamps (Fig. 4526), and finally tie the proximal ends of the structures after the removal of the kidney mass. Judgment must be used in the individual case in handling the pedicle _ which

is usually the crux of the situation – especially in complicated cases. Particularly should the ureter be doubly ligated in infected cases – and the stumps of the ureter be cauterized and protected. The wound should be kept from soiling by gauze pads.

It is sometimes easier to deal at first only with the double ligation and division of the ureter – after which better access can be gotten to the renal artery and vein – especially in cases of large tumors and extensive adhesions. In these cases, after the ureter is divided, it is well to clamp the balance of the pedicle, artery and vein, before undertaking their ligation and division. Where



Fig. 4526.—Lumbar Nephrectomy – Severing the Structures of the Pedicle Between Clamps: – a, a, Double clamps of ureter; – b, b, same of renal vein; – c, c, same of renal artery, which has been divided; – d, kidney under moderate traction to expose its pedicle.

the pedicle has been clamped and the individual structures then tied, it is often safest to also again ligate artery and vein, this time together, between the clamp and the aorta and vena cava. Care should be exercised not to twist the pedicle in the operative manipulations – and the structures should be relaxed during the tying of the ligatures.

The question of drainage will largely depend upon the nature of the case – but at least temporary drainage is indicated in the majority of cases. If there be no infection the ligated end of the ureter is generally cauterized or wiped with some antiseptic solution and dropped back into the wound. In markedly infected cases the ureter should be anchored in the wound and

drained, and in still other cases a drain may be carried down to the end of the ureter.

The wound is closed by buried layer suturing, up to the drain, if one be used.

Comments.—Guard the vena cava, which has been wounded in operating upon the right side.

Sometimes the fatty capsule must be removed – necessitating the removal of the entire mass from the surrounding tissues.

The peritoneal cavity is often accidentally opened, or purposely, to examine the opposite kidney, and other structures – but should be closed by suture.

The pleural cavity may be opened in working near the twelfth rib – and should be immediately sutured.

The colon may be wounded and require repairing.

A large space is left by the removal of the kidney – and considerable oozing is apt to follow.

TOTAL NEPHRECTOMY, IN GENERAL

The most frequent indications for the total removal of the kidney are – malignancy – tuberculosis – extensive or marked infection – calculus – uronephrosis and uropyonephrosis – tumors – cystic (hydatid) disease – aneurysm of the renal artery – injuries – and some involvements of the ureter.

Under no circumstances is total nephrectomy warrantable unless it be demonstrated in advance that the opposite kidney is present and performing reasonable function. This information should, preferably, be secured in advance by differential ureteral catheterization. If it have not been previously done before the operation, then the condition of the opposite kidney should be digitally examined at the time of the operation and prior to the removal of the involved kidney. An additional means of verifying the presence of the kidney in advance of operation is by radiography of the kidney and ureter – after catheterizing the ureter and injecting a suspension of colloid silver into the pelvis and calices.

The routes and methods by which the kidney is most usually approached, in performing nephrectomy, are – lumbar, paraperitoneal, transperitoneal, subcapsular, and by morcellation. Nephrectomy by the lumbar route is the operation most frequently performed – but in some cases of involvement of the kidney by large tumors, or by extensive processes, the simple lumbar route will often not suffice to give room – and either some prolongation or modification of the usual method of approach must be made, or some other route adopted.

The lateral paraperitoneal method of approach may be generally considered the second method of choice, where the lumbar route gives insufficient room, and where the maximum degree of exposure is not indicated, and intraperitoneal complications are not suspected – as in many large tumors.

The transperitoneal method of approach is especially indicated where the maximum exposure must be made, and where the peritoneum or intraperitoneal organs and structures are supposed to be involved. Langenbuch's lateral paramedian transperitoneal approach, on the side of the involved kidney, is often preferred to the median abdominal section in approaching the intra-abdominal route.

SUBCAPSULAR NEPHRECTOMY

BY THE LUMBAR ROUTE

Description.—Where a dense, perirenal capsular mass surrounds the kidney and is firmly adherent to the peritoneum, colon, vena cava, diaphragm,

and other structures _ so that damage to these structures would likely result in attempting to separate such a capsule, this fatty areolar capsule is incised and the incision carried also through the proper fibrous capsule of the kidney _ which is then peeled back to and, if possible, into the pedicle _ which is then ligated, or clamped, and the kidney removed. The cavity of the capsule is then cureted (where indicated) and packed _ the abdominal wall wound being closed up to the packing. The best approach in such cases is by the oblique lumbar incision.

Preparation _ Position _ Landmarks _ Incision.—As for exposure of the kidney by the lumbar incision (v. p. 302).

Operation.—The operative steps, up to the exposure of the perirenal connective tissues, is the same as in ordinary operation _ as in nephropexy, for instance. But beyond this point the technic differs considerably _ owing to the fact that the adhesions and other complications associated with the case, and which comprise the chief indications for the adoption of the subcapsular method of excising the kidney, are the very conditions which prevent



Fig. 4527.—Subcapsular Lumbar Nephrectomy; _ The combined (unseparated) fatty areolar and fibrous capsules have been incised from pole to pole _ after which, by blunt instrumental and finger dissection, the kidney proper is freed of its coverings, back to and including the beginning of its pedicle.

the free delivery of the kidney into the lumbar wound _ so that, as generally performed, the manipulations must be carried on with the kidney lying, practically, unmoved from its bed. The organ is, however, rendered as accessible as possible, as a means of simplfying the subsequent steps.

The incision through the perirenal capsule is also, and at the same time, carried directly through the proper fibrous capsule of the kidney _ but not into the kidney substance. As soon as the cleavage line between the fibrous capsule and the kidney cortex is recognized, the divided margin of the proper capsule (with its overlying perirenal capsule still adherent and undisturbed) is seized with broad-tipped forceps, and a curved, blunt dissector insinuated between capsule and cortex _ and in this way the backward peeling of the combined and adherent perirenal and proper capsules from the kidney is commenced. As soon as this freeing has been well started it is generally best to substitute two fingers for the blunt dissector _ working backward and downward in the manner suggested in Fig. 4527. This freeing is carried, in turn, over the posterior and the anterior surfaces of the kidney, and the upper and lower poles _ and downward and backward, as far as possible, over the pelvis and

the beginning of the ureter and of the vascular pedicle of the kidney. The further back the freeing can be carried and the more of the structures of the pedicle that can be bared and freed, ready for clamping and ligating, the more satisfactory and the easier is the technic. Gentle traction upon the kidney at this stage will aid – but it is to be remembered that a kidney freed of its fibrous capsule is a much frailer structure than normal and, therefore, easily ruptured. One aims at securing such exposure of the pedicle as is shown, rather exaggeratedly, in Fig. 4528 – though rarely attaining – in order that he may clamp the constituent structures of the pedicle *en masse* as there illustrated. This, however, is rarely possible. Very much more likely is it that the work of securing the pedicle will have to be carried on out of sight – and by feeling only – as seen in Fig. 4529 – where only the Surgeon's left fore-

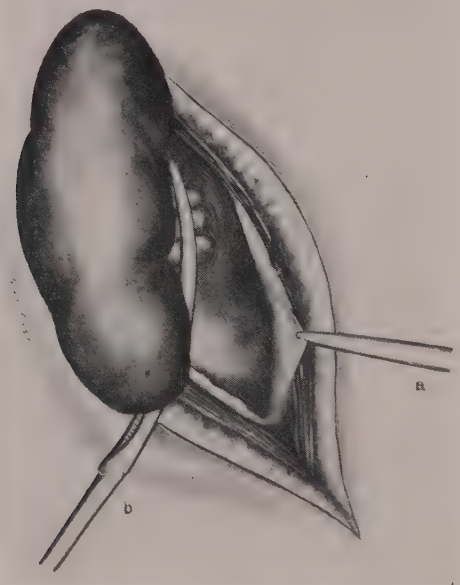


Fig. 4528.—Subcapsular Lumbar Nephrectomy; – The capsule has been split and, grasped by forceps, a, peeled back on either side and over the poles by blunt dissection – down to and over the pedicle – exposing the vessels and ureter – which are then seized with curved clamps, b – after which the pedicle is divided between kidney and clamp – and its constituent structures tied.

finger will guide him in saddling the structures of the pedicle with the two blades of the clamps, and passing their ends well on and safely beyond them.

If it be a possible thing to sufficiently expose the pedicle to admit of ligating its individual structures *in situ* – either without first applying a clamp, or after applying a clamp – it is best to do so. But in many cases this cannot be done, and one must simply clamp the pedicle *en masse* by feeling – and then pass a pair of curved scissors on down, also guided by feeling and by the opposite forefinger, and severing the pedicle well distal to the clamp – leaving sufficient room beyond the clamp to make sure of the hold – and also enough of the pedicle structures projecting beyond the clamp for ligatures to hold. It is better, if possible, to ligate each individual structure of the pedicle first – and then, if indicated, the situation may be further safeguarded by throwing

a mass ligature around the renal artery and vein, in addition. Sometimes there is no opportunity to do more than leave the originally clamped structures as they are first seized _ and, after dividing the parts beyond the clamp, leave the clamp *in situ*, projecting from the lumbar wound. On the other hand, it may be possible (and it is often desirable) to adopt the technic suggested by Albarran _ that is, clamp the pedicle *en masse* _ divide the structures beyond the clamp, and remove the kidney mass _ then circularly trim the capsule mass (combined and adherent fatty and fibrous capsules) as closely around the pedicle as possible _ the removal of this mass of tissue (whether in more

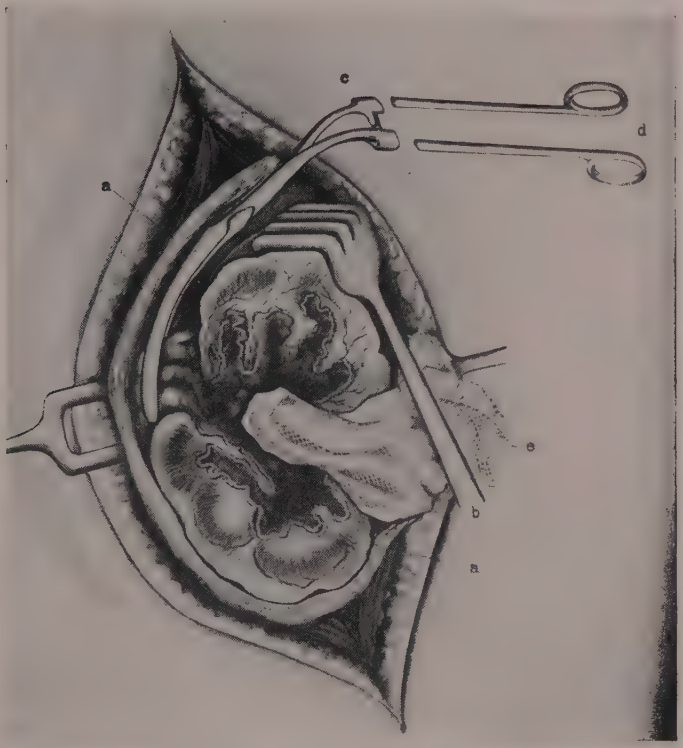


Fig. 4529.—Subcapsular Nephrectomy of a Pus-riddled Kidney: _ **c**, Curved, detachable-handle clamps introduced between the kidney and the separated capsule to control the pedicle (**c**, the blades; _ **d**, the handles); _ **b**, retractor of the upper pole of the kidney, to enable the clamp to reach and surround the pedicle; _ **e**, gauze packed into the pus-hollowed kidney; _ **a**, **a**, the separated, thickened capsule. (This picture is somewhat distorted, as simultaneously representing a surface view and a partial sectional view.)

or less of a continuous ribbon, or in tags) giving considerable additional room for access to the structures which are to be ligated _ the remaining cuff of adherent fatty and fibrous capsule then often being able to be rolled back, cuff-fashion, so that the structures of the pedicle can be picked up and more carefully ligated than would be otherwise possible. If finally there be any question about the safety of the ligatures, the clamp should be left in position, projecting from the lumbar wound for several days _ and, in such an event, a clamp with detachable handles, as illustrated, is desirable.

The cases in which this method of operating is called for almost invariably also call for more or less prolonged packing and drainage of the wound. Up

at least to the exit of the drain or pack (usually both) the lumbar wound is closed by layer suturing.

Comments.—In all kidney excisions the control of the pedicle is, naturally, the most important step _ and usually the most difficult. In this particular technic it is especially so _ owing to the difficulty of peeling back the combined and adherent capsule sufficiently to get at the artery, vein, and ureter.

In cases of the category in which this method of operating is indicated, the perirenal tissues may have become a fibrous mass, everywhere densely adherent _ and sometimes the kidney is honeycombed with suppurating tracts and calculi _ or invaded by a tumor mass.

If the ureter can be first controlled and divided, it is much easier to deal with the vascular part of the pedicle.

Sometimes the combined capsules can only be removed piece by piece, catching one part by forceps and excising it with curved scissors _ and then another.

Parts of the capsule adherent to structures whose importance is great in case of injury such, for example, as the pleura and the colon, are often best left *in situ*.

LUMBAR NEPHRECTOMY

BY MORCELLATION

Description.—Excision of the kidney by morcellation, or by morcellement, consists in the removal of the organ piecemeal. Much that has been said of subcapsular nephrectomy also applies here. The method is indicated in difficult cases of adhesions and complications, as in calculi, infection, tuberculosis, and tumors. Nephrectomy by morcellation and subcapsular nephrectomy may, in a sense, be considered alternate technics _ to be adopted when ordinary, simple lumbar nephrectomy cannot be performed _ and as being, in the judgment of the Writer, second in choice (because of being less surgical) to subcapsular nephrectomy _ the order of desirability being _ simple lumbar nephrectomy _ subcapsular lumbar nephrectomy _ lumbar nephrectomy by morcellation.

Preparation _ Position _ Landmarks _ Incision.—As for exposure of the kidney by the lumbar route.

Operation.—The same difficulties are here experienced as described in the operation by the subcapsular method. In adopting the morcellation method it usually amounts to having first endeavored to remove the kidney by the subcapsular method _ and to have made some progress in this, before being convinced of the impossibility or unwisdom of proceeding with the technic. And, under such circumstances as these, in switching to the morcellation method, one takes up the steps of the last where the first was left off. That is, with the kidney partly freed of its combined and adherent perirenal and fibrous capsules, the effort to continue along these lines is blocked _ because of lack of access. And in order to gain access _ the exposure of the renal pedicle being the goal _ one must resort to biting or nibbling away pieces of kidney tissues, piecemeal, in order to make more room and thereby gain better access to the pedicle. It is best to settle upon some part of the kidney for the beginning of the biting away process _ and the lower pole is best bitten away first _ as its absence will better enable the upperpole to be drawn down from behind the ribs _ the middle of the kidney then occupying the position of the former lower pole. The first step in the actual removal of the lower pole is to clear, by blunt dissection, a path for the passage of a clamp between the middle of the kidney and the lower pole. This region is clamped firmly enough to control circulation _ and then, with curved scissors, the lower pole is excised. The method of

first placing the clamp between the middle and the pole of the kidney is shown in Fig. 4530, **a**. After the clamping this pole is excised _ the rest of the kidney

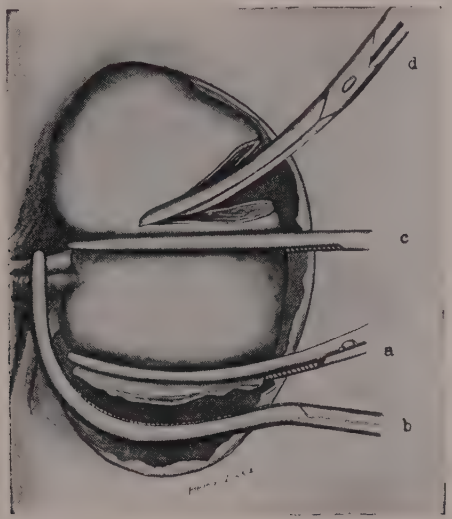


Fig. 4530.—Nephrectomy by Morcellation; _ The lower pole of the kidney controlled by clamp, **a**, has been amputated _ after making a path for clamp and scissors through the combined and adherent fatty areolar and fibrous capsules. In the space thus made a special clamp, **b**, is passed and grasps the pedicle. A clamp, **c**, is here shown controlling the upper pole, while scissors, **d**, sever it. Finally, the central portion is also removed and the pedicle ligated.

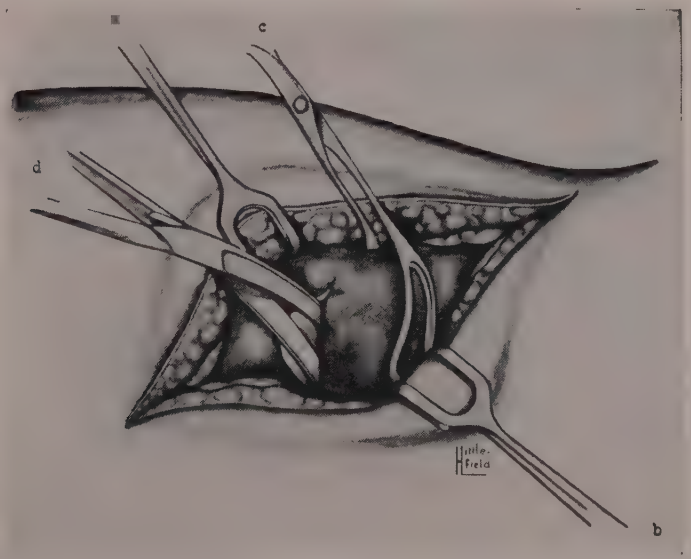


Fig. 4531.—Lumbar Nephrectomy by Morcellation: _ **c**, Special kidney forceps steadying the adherent kidney; _ **d**, blunt-pointed scissors excising the kidney in piecemeal. Bleeding should be controlled by first clamping off the part to be excised, proximally to the site of section.

is displaced downward in the wound _ and then a second clamp made to grasp the kidney between its middle and the upper pole _ after which the upper pole

is similarly amputated (v. Fig. 4530, **c** and **d**). When both poles have been excised much more room is secured _ and the next step usually consists in passing a pair of curved clamps, through the pathway made by the excision of the lower pole, and securing the three structures of the pedicle (v. Fig. 4530, **b**). With both poles cut away, still mero room is given to shift the kidney in its bed _ and to pass a curved clamp around behind it and grasp its pedicle (if this has not been done following the excision of the lower pole) compressing the three structures. Scissors are then passed down between the kidney and the clamp, and the pedicle divided distally to the clamp _ after which the individual structures of the pedicle are taken up and ligated separately _ and the clamp removed. A surface view of the use of the scissors in an unclamped case is seen in Fig. 4531.

The large cavity usually left in this class of cases is generally packed with gauze _ or may be simply drained with a couple of rubber tubes _ as indicated.

Comments.—Curved and right-angled clamps, as well as clamps with detachable handles, are useful in these cases.

If the pedicle can be clamped after excising the lower pole, so much the better, rather than after excising both poles.

In some of these cases the kidney has undergone so much change, as not to bleed excessively when cut.

If the kidney be very friable, as in some cases of tumor infiltration, it may be difficult to apply the method.

It may be necessary to leave the clamp upon the compressed pedicle for three or four days.

If oozing be still present when the wound is dressed, it is packed tightly with gauze _ otherwise loosely. If clamps are left *in situ* they are kept from pressing upon the margins of the wound.

LATERAL PARAPERITONEAL NEPHRECTOMY

Description.—Exposure and removal of the kidney by the lateral transabdominal but extraperitoneal route. This method of excising the kidney was at first resorted to for the intermediate types and degrees of kidney involvement _ in which the lumbar route did not afford sufficient exposure _ and in which, on the other hand, it was not necessary to resort to the maximum amount of room for manipulation through the transperitoneal route. As the technic was improved, however, the paraperitoneal route came to be more and more employed, even for major types of cases _ since as much room for manipulation can be secured by it.

Preparation _ Position _ Landmarks _ Incision.—As for exposure of the kidney by the lateral paraperitoneal route (v. p. 322).

Operation.—One of two sets of conditions are apt to obtain; _ Either the operation will have been begun as an exposure of the kidney by the usual oblique lumbar incision, and in the course of operation be found to afford insufficient room for the needed manipulation _ and in such a case some additional incision is generally added to the original incision, either a transverse cut, running toward the median line from the original cut _ or an extension from the upper end of the original incision, obliquely upward and inward below the costal arch _ or obliquely downward, above Poupart's ligament; _ or the operation may have been planned from the first as a paraperitoneal approach, and one of the incisions adopted which has been described under the exposure of the kidney by the anterolateral paraperitoneal route _ usually by a combination of incisions, the vertical one of which lies in the semilunar line, or just to the outer side of it, combined with a transversely running

incision, extending backward from the vertical cut (v. Fig. 4432). In the present instance the parts are shown exposed by the barn-door incision, in Fig. 4532 _ (for explanation of which v. p. 326 and Fig. 4434).

Whichever one of these incisions of approach is adopted, as soon as the incision has passed through the abdominal wall, and entered the transversalis fascia, the parietal peritoneum is recognized _ and henceforth carefully guarded

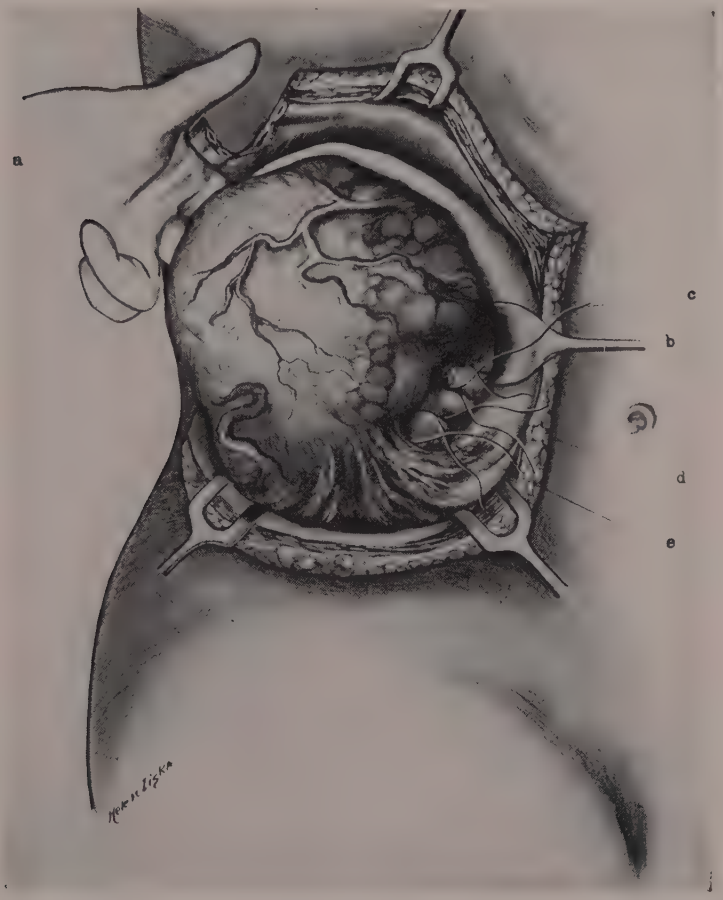


Fig. 4532.—Removal of Hypernephromatous Kidney by the Paraperitoneal Route, Through the Barn-door Incision: _ Retractors are drawing apart the margins of the wound. The division of the eleventh and twelfth ribs is shown. a, Fingers, freeing the tumor mass from the peritoneum and abdominal wall; _ b, retracting the unopened peritoneum, mediad; _ c, ligature of renal artery; _ d, of the renal vein; _ e, of the ureter.

against incision or tear. It is tripped from the lateral and posterior abdominal wall by blunt dissection and without opening its cavity. This is largely accomplished by the gloved fingers _ and is begun by separating it from the lateral wall first, while, at the same time, the abdominal contents within the peritoneal sac are held retracted toward the median line by an Assistant. As soon as the perirenal fatty connective tissue of the kidney is reached, in the process of the backward freeing, it is opened and the kidney exposed _ the ease, or otherwise, with which these steps will be accomplished depending upon

the complication and adhesions in the particular case. The entire kidney is freed, anterior surface, upper and lower poles, and posterior surface. The renal artery, vein, and ureter are separately ligated _ with double ligatures and divided between the ligatures _ after which the kidney is excised.

The circumstances under which this type of operation is called for generally demand at least temporary drainage _ which is difficult to provide for anteriorly or laterally _ so that when drainage is indicated it is usually accomplished through a counteropening made in the lumbar region by cutting against an instrument inserted from within the abdomen.

Comments.—The more vertical portion of the incision of approach may begin just below the free end of the tenth or of the eleventh rib _ and is carried thence obliquely downward, just outside of the linea semilunaris, to just above the anterior superior iliac spine. A transverse incision may be carried backward from the middle of this incision to the anterior border of the quadratus lumborum muscle, if more space be needed. If the incision is kept 2.5 cm. (1 inch) below the tenth rib, the tenth nerve is saved _ and if the incision does not come within 2.5 cm. (1 inch) of the anterior superior iliac spine, the eleventh nerve will be saved.

This type of operation is often resorted to in the case of complex tumors of the kidney, and the perirenal fatty tissue can be displaced along with the kidney mass by getting into the cleavage line between the perirenal capsule, on the one hand, and the quadratus lumborum and psoas muscles, on the other.

Enlarged glands are removed along with the tumor mass _ or separately. Those which are removed separately are dissected out with the remainder of the fatty connective tissue _ which is more easily and safely done in the larger working room left after the kidney has been removed.

The wound of the abdominal wall is closed with very careful layer suturing reconstructing it against possible future hernia.

TRANSPERITONEAL NEPHRECTOMY

BY THE ANTERIOR ABDOMINAL ROUTE

Description.—In transperitoneal nephrectomy the abdomen is usually opened by an incision lying in the linea semilunaris overlying the involved kidney. Other Surgeons select a vertical line lying to the outer side of the linea semilunaris. In either case the incision begins at the costal arch and extends downward to the lower limit of the tumor or even lower. One of these is the incision most frequently selected in the transperitoneal operation _ but where the tumor is particularly large, and apt to be especially complicated, the median abdominal section is frequently employed. Upon the whole, however, transperitoneal nephrectomy, by any route, is now less often employed than formerly _ while, correspondingly, the paraperitoneal method is more frequently used and has largely replaced the former. To summarize, the exposure by paramedian incision gives the most direct approach _ while the exposure by the median incision gives the greatest amount of room for large tumors encroaching upon the median line. The method is usually resorted to in cases of unknown or in extensive kidney injury, and in large growths.

Preparation _ Position _ Landmarks _ Incision.—As for median or paramedian abdominal section (v. p. 329).

Operation.—On entering the abdomen, whether by paramedian or median incision _ and after retraction of the parts _ a general digital examination should be made of the disposition of the structures _ and the condition of both kidneys, and of both ureters. The intestines are then disposed of, pre-

paratorily to incising the posterior peritoneum _ by displacing the small intestines upward and inward, and the ascending, or descending colon, as the case may be, inward _ and holding them so by packing with gauze pads, and by retractors, aided by position. After drawing the colon well mediad, a vertical incision is made through the posterior parietal peritoneum, overlying the involved kidney. This incision will lie about 4 cm. (1½ inches) to the outer side of the colon _ and is either made altogether by knife, or is begun by knife and increased by scissors. The difficulty is greater in carrying on the incision outside of the colon through a median than through a paramedian incision of that side _ and more difficulty is experienced, as a rule, in incising the parietal peritoneum to the outer side of the descending colon than in incising it to the outer side of the ascending colon _ as on the left there is greater likelihood that the renal growth may have so displaced the colon as to cause it to lie either across the tumor, or even to its outer side (Taylor). Sometimes the disposition of the parts is such that the posterior parietal peritoneum must be incised transversely _ and sometimes even to the inner side of the colon. Care is always exercised in such cases to incise the peritoneum between the course of vessels, as the division of an important nutrient colonic vessel might prove disastrous to the integrity of the colon.

The fingers are now passed through this incision down upon the kidney _ the perirenal fat is incised and the kidney enucleated by blunt dissection. The pedicle is first to be cleared _ by stripping off the peritoneum toward the aorta or the vena cava. The vessels are then ligated with silk passed by means of an aneurysm needle _ tying, preferably, the artery first, then the veins. If room be sufficient, double ligatures should be used, providing for division between them, _ if not, the pedicle may be clamped near the kidney (instead of the second ligature). The pedicle is now divided between the two sets of ligatures _ or between the clamp and ligatures. The ureter should be separately, doubly ligatured and similarly divided. The ligatured stump, with or without cauterization, as indicated, is returned to the abdomen. The kidney is then further enucleated from its perirenal fatty areolar tissue and removed. All bleeding vessels are gut ligatured.

In some cases it is easier to first ligate the three structures of the pedicle, and then enucleate the kidney _ though this is exceptional. The enucleation is accomplished by blunt dissection, preferably with the finger _ working with extreme care toward the aorta, on the left, and toward the vena cava, on the right. The enucleation should begin, usually, at the lower, outer aspect of the organ _ peeling back the peritoneum carefully, and entering the cleavage plane between the perirenal and the true kidney capsules.

It may not be possible to recognize the ureter until after the renal artery and veins are tied and divided _ which will tense the ureter in manipulating the kidney _ and admits of its being doubly ligated, divided, and disinfected. If possible, the renal artery should be tied first, and then the veins doubly tied, with triple knots or reinforced by mass ligature.

All broken down, involved capsular and glandular tissue should be removed, after freer access is secured, following the excision of the kidney. If indicated, the suprarenal body is also removed.

Drainage is usually indicated in these cases _ and is usually secured in one of two ways: _ Either a counteropening may be made through the lumbar region, upon an instrument pressed against the lumbar wall from within the abdominal wound _ after which the parietal peritoneum is closed by suture _ and the anterior abdominal wound closed by layer suturing. Or the renal cavity may be cut off from the general peritoneal cavity and drained through a part of the original wound of approach. This is accomplished by first suturing

up a part of the ends of both the incised posterior parietal peritoneum, over the region of the kidney, to the outer side of the colon, and also part of the ends in the incised anterior parietal peritoneum, made in entering the abdominal cavity _ and then suturing together the remaining inner margins of the anterior and posterior parietal peritoneum, and also the remaining outer margins of the anterior and posterior parietal peritoneum _ thus constituting a central extraperitoneal corridor, as it were. Through this, drainage may be established, without involving the peritoneal cavity proper. This drainage may suffice, or be combined with a lumbar drain. The general wound is closed, up to the drains, by layer suturing.

CHAPTER LXXV

OPERATIONS UPON THE URETERS

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SURGICAL ANATOMY OF THE URETERS

Description.—Fibro-elastic tubes of about 3 to 4 mm. ($\frac{1}{8}$ to nearly $\frac{3}{16}$ inch) in diameter _ flattened from before backward _ with walls of about 1 mm. ($\frac{1}{25}$ inch) in thickness. They consist of outer, fibrous _ middle, muscular _ and inner, mucous coats. They have an average length in the male of about 30.5 cm. (12 inches) _ extremes being from 25.5 to 40.5 cm. (10–16 inches). They are about 7.5 cm. (3 inches) apart at their beginning _ about 5 cm. (2 inches) apart near the sacro-iliac joint _ about 3.2 cm. ($1\frac{1}{4}$ inch apart at entrance to bladder _ and about 2 to 2.5 cm. ($\frac{3}{4}$–1 inch) apart at their bladder mouths. The ureters begin in the funnel-shaped pelvis of the kidney, opposite the spinous process of the first lumbar vertebra _ and run downward through a sort of lymph-space between the laminæ of the subperitoneal connective tissue, downward and inward through the lumbar and pelvic regions _ ending in the base of the bladder. The genitocrural nerve is in close relation with the ureter. There are three sites at which the ureter is narrower than elsewhere, _ between 4 and 5 cm. ($1\frac{1}{2}$ and 2 inches) from the pelvis of the kidney _ crossing of iliac artery _ and at junction of pelvic and vesical portions.

Course and Relations.—(1) Abdominal portion; Male and Female: _ (*a*) Right Ureter, _ Runs downward and slightly inward, from pelvis of kidney to promontory of sacrum, where it crosses either common or external iliac

artery. Rests (posteriorly) upon psoas muscle and fascia, genitocrural nerve, common or external iliac artery. Covered (anteriorly) by peritoneum, spermatic and colic vessels, and ileum. Internally, lies the inferior vena cava, near ureter. (*b*) Left Ureter, – Runs downward and slightly inward, from pelvis of kidney to promontory of sacrum, where it crosses either common or external ilac artery (same course as right ureter). Rests (posteriorly) upon psoas miuscle and fascia, genitocrural nerve, common or external iliac artery (same posterior relations as right). Covered (anteriorly) by peritoneum, spermatic and colic vessels, and sigmoid colon. Internally, lies abdominal aorta, being 2.5 cm. (1 inch) from ureter above, and 1.3 cm ($\frac{1}{2}$ inch) below, near bifurcation. (**2**) **Pelvic portion; Both sexes; Both sides:** – Runs downward in front of sacro-iliac joint – passes upon obturator internus and its fascia, lying inferiorly and internally to psoas – enters posterior false ligament of bladder (rectovesical fold, in male – uterovesical fold, in female) below the obliterated hypogastric artery – hence its course differs in the two sexes: – (*a*) **Male; Both sides:** – It is here crossed above and to inner side by vas deferens, which intervenes between it and bladder – and, just before entering bladder, it passes beneath the free extremity of the vesiculæ seminales. The two ureters are about 5 cm. (2 inches) apart at base of bladder, and about 4 cm. ($1\frac{1}{2}$ inches) posterior to the prostate gland. (*b*) **Female; Both sides:** – It passes down parallel with the cervix uteri and upper part of vagina – lying about 5 mm. ($\frac{1}{5}$ inch) external to cervix opposite os internum – running posteriorly to uterine artery, through the uterine venous plexus, and below the broad ligament – crossing the vagina opposite its upper third, to the vesicovaginal interspace, and entering the bladder opposite the center of the vagina. (*c*) **Intravesical portion; Both sexes, Both sides:** – Entering the bladder 4 to 5 cm. ($1–2\frac{1}{2}$ inches) apart, the ureters pass obliquely downward and inward through its wall, emerging upon the mucous membrane about 2 cm. ($\frac{3}{4}$ inch) apart, and about the same distance posterior to the meatus urinarius internus.

Arteries.—From renal, spermatic, internal iliac, and inferior vesical.

Veins.—End in corresponding trunks.

Lymphatics.—Empty into pelvic and lumbar glands and into receptaculum chyli.

Nerves.—From spermatic, renal, and hypogastric plexuses.

SURFACE FORMS AND LANDMARKS OF THE URETERS

As the ureters are about 7.5 cm. (3 inches) apart at their commencement at the pelves of the kidneys, opposite the first lumbar spinous process, the beginning of each ureter will lie about 4 cm. ($1\frac{1}{2}$ inches) external to the line of the spinous processes, on a level with the spinous process of the first lumbar vertebra. And they lie about 5 cm. (2 inches) apart near the sacro-iliac articulation – or about 2.5 cm. (1 inch) from the median line.

Anteriorly, the line of the ureters, from the kidneys to the brim of the pelvis, may be gotten, approximately, by drawing a line vertically upward from the junction of the inner and middle thirds of Poupart's ligament. And the position of the crossing of the ureters over the brim of the pelvis may be approximately represented by the intersection of a vertical line extending upward from the spine of the pubis, with a horizontal line between the anterior superior iliac spines.

Comparatively few surgical landmarks, available for practical application, are to found in operating upon the ureters. In working extraperitoneally, it is generally best to first expose the renal pelvis, and trace the ureter thence downward toward the bladder.

The spermatic vessels usually cross the ureter at about its middle – their upper part lying to the inner side of the ureter, and their lower part, to the outer side.

Ureteral calculi are most frequently found in the pelvic portion of the ureter.

In exposing the ureter from within the abdominal cavity, the most constant landmark is the deepest part of the groove to the side of the promontory of the sacrum, over which the ureter passes from the abdomen into the pelvis – and, recognizing it here, from this site, its abdominal portion may be traced upward – and its pelvic portion downward.

In operating within the female pelvis the ureter is best located just prior to its entering the broad ligament – which is accomplished by taking up the utero-sacral fold at its posterolateral attachment to the uterocervical region – the ureter lies just to the outer side of this fold, and approximately parallel with it.

GENERAL SURGICAL CONSIDERATIONS

The ureter is so intimately adherent to the peritoneum that when the peritoneum is stript up, the ureter is almost always reflected along with that membrane and adherent to it.

In all suturing about the ureter an attempt should be made not to include the mucous membrane – though, practically, this may often be done unintentionally. The fibrous and part of the muscular coats should be taken up by the stitch.

Fine silk is the suture material generally used for non-penetrating, and fine catgut for penetrating, sutures.

There is a tendency to narrowing at the site of suture, especially after transverse divisions.

Extrapelvic portions of the ureter are preferably approached retroperitoneally – except where the cause for the operation upon the ureter arises, or is discovered, during an intra-abdominal operation.

Intrapelvic portions of the ureter are accessible by incision through the abdominal wall, bladder, rectum, vagina, perineum, or by sacral resection.

Longitudinal wounds of the ureter heal better than transverse ones.

Drainage is indicated in all cases where infection is present or suspected, or where the technic is uncertain.

In retroperitoneal operations suture is less absolutely necessary, provided drainage be established down to the wound.

Whenever the ureter is opened intraperitoneally the peritoneum or omentum should be sutured over the wound, so as to make it extraperitoneal.

Where the ureter has been divided and must be transplanted, implantation into the bladder is the most desirable.

Where the ureter has been completely divided transversely, it should be repaired by uretero-ureterostomy, if possible.

Where the division is near the kidney, and uretero-ureterostomy cannot be performed, it should be implanted into the pelvis of the kidney. If the division be low down, it should be implanted into the bladder.

If such an extent of ureter be lost that uretero-ureterostomy cannot be performed, or the end cannot be implanted into the pelvis of the kidney, or into the bladder, implantation into the bowel, or skin should be done.

Longitudinal wounds of the ureter generally heal without suture if retroperitoneal drainage be provided.

Where it is possible, any operation should be protected by peritoneum – in one of two ways: – (*a*) Lift the ureter up out of its bed, at the site of operation, into the peritoneal cavity – and draw the peritoneum around the ureter

from both sides, so stitching the serous membrane as to form a tube through which the ureter runs, practically excluding it from the general peritoneal cavity. The suturing should, however, be lightly and carefully done, forming a loose tube, so as to avoid subsequent contraction. This is probably the better method. (*b*) The site of operation upon the ureter may be surrounded by a detached piece of omentum lightly sutured to the ureter.

The ureter has been separated for as much as 8.3 cm. ($3\frac{1}{4}$ inches) from its attachments without gangrene – owing to the long artery which accompanies it and is intimately connected with it.

The ureter may be lengthened 2.5 cm. (1 inch) or more by steady, gentle traction.

When a gap in ureter at the lower end cannot be bridged by stretching, a vesical diverticulum can sometimes be turned up to meet the end of the ureter.

Uretero-ureterostomy is generally practicable except in the lower 2.5 cm. (1 inch) in the male, and the lower 5 cm. (2 inches) in the female.

In severed ureter the best course is uretero-ureterostomy – and the next best, ureterocystostomy (v. i.).

Normal urine is not injurious to the peritoneal cavity, but it is well not to let it come in contact if it can be helped.

In opening the peritoneum within the abdomen, to expose the ureter, the parietal peritoneum should be incised about 1 cm. ($\frac{3}{8}$ inch) from the ureter and retracted – so that the periureteral sheath and the blood-supply will be preserved.

The operative surgery of the ureters may, for brevity, be grouped under two headings – the exposure of the ureters – and the operative technic necessary for meeting the special pathologic condition encountered.

The two general methods of exposure are – the extraperitoneal, always desirable when it will accomplish the indications – and the transperitoneal.

The technical procedures usually carried out after the ureter has been exposed are – incision, generally for stone – suturing of wounds and incisions – various forms of anastomoses, of the parts of the ureter with each other, and with other viscera, or the skin – various forms of drainage – plastic procedures for strictures and fistulas – partial or complete excision – and the like.

The exposure of the ureter may be made deliberately – or may be done in the course of some other operation. Most of the operations for exposure of the kidney generally also admit of exposure of more or less of the ureter. The ureter may be exposed extra- or intraperitoneally.

Abdominal portion of the ureter is best exposed by the oblique lumbar incision used in exposing the kidney, extending from the twelfth rib above, to about the center of Poupart's ligament. This incision will enable the upper three-fourths of the ureter to be freely exposed, and will allow of access to the entire ureter, from kidney to bladder – though, of course, not so free access to the lower fourth. It is possible to thus expose the entire ureter extraperitoneally. This exposure should be the one of preference for the upper three-fourths of the ureter (and may be resorted to for even the entire ureter) – except when the ureter is exposed in the course of abdominal section.

Pelvic portion of the ureter is readily accessible through the lower median abdominal incision – followed by retraction of the intestines (especially aided by the Trendelenburg position) – and division of the peritoneum over the course of the ureter. The intrapelvic portion may also be exposed extraperitoneally by incision through the bladder, vagina, rectum, male perineum, or by sacral resection.

Intravesical portion of the ureter may be exposed through a cystotomy wound (incision of the bladder) – generally by the suprapubic route.

In operating transperitoneally the opening is usually made in the semilunar line if it be known which is the involved ureter _ otherwise, in the median line.

EXTRAPERITONEAL EXPOSURE OF THE KIDNEY AND THE ENTIRE URETER

BY OBLIQUE LUMBO-ILIO-INGUINAL INCISION

Description.—This incision will allow the kidney and the upper three-fourths of the ureter to be freely exposed _ and will give access to the entire ureter, though, of course, not such free access to the lower fourth _ the exposure being retroperitoneal throughout. This exposure of the ureter is the one most frequently employed.



Fig. 4533.—Incision for the Extraperitoneal Lumbar Exposure of the Kidney, and for the Extraperitoneal Lumbo-ilio-inguinal Exposure of the Entire Ureter; _ beginning about the middle of the twelfth rib _ running, thence, downward and forward in the direction of a midpoint between the center of the iliac crest and the anterior superior iliac spine _ thence skirting the anterior superior iliac spine _ and passing downward and forward, parallel with Poupart's ligament.

Preparation.—As for exposure of the kidney by an oblique lumbar incision.

Position.—The patient lies in the semiprone posture during the work in the upper part of the wound _ and in the semidorsal during the work in its lower portion. The patient may be placed in Trendelenburg's position for the pelvic ureter.

Landmarks.—Twelfth rib; outer border of erector spinæ muscle; iliac crest; anterior superior iliac spine; Poupart's ligament.

Incision.—Begins just below or over the twelfth rib, at the angle of junction of the twelfth rib and the outer border of the erector spinæ muscle _ and passes thence obliquely downward toward and to within 2.5 cm. (1 inch) of the anterior superior iliac spine _ thence downward and parallel with and about 2 cm. ($\frac{3}{4}$ inch) above Poupart's ligament, to just below its center (Fig. 4533).

Operation.—The first part of the operation and the exposure of the kidney are conducted as in the more limited procedure of exposing the kidney alone

by an oblique lumbar incision (p. 302). In the lower aspect of the wound the ureter is in relation with the peritoneum and ascending colon on the right side, and the peritoneum and descending colon on the left. The colon, in either case, is retracted toward the median line, together with the peritoneum, exposing the psoas muscle and the spermatic and colonic vessels. The ureter has a tendency to cling to the peritoneum as it is displaced (v. Fig. 4534). A large retractor draws the intestines toward the median line. The ureter is isolated at the lower pole of the kidney _ and is carefully traced down to the iliac vessels _ separating the peritoneum by blunt dissection and retracting it inward from the course of the ureter _ the superficial incision having been

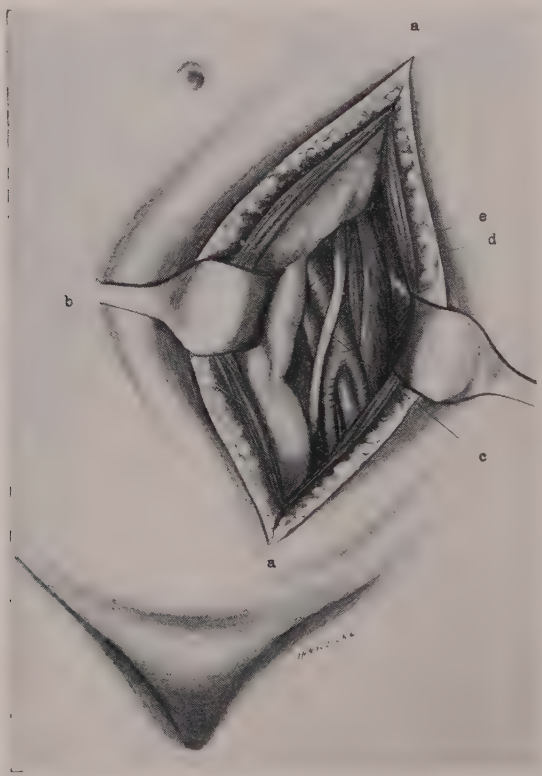


Fig. 4534.—Extraperitoneal Exposure of the Ureter _ in its Middle and Lower Parts: _ a, a, Oblique, lumbo-abdominal incision; _ b, retraction of the unopened peritoneum; _ c, ureter crossing the common iliac artery and vein; _ d, psoas minor; _ e, psoas major.

deepened through skin, fascia, external, internal, and transversalis muscles, and aponeuroses down to the subserous areolar tissue _ in which plane the separation of the ureter is accomplished (Fig. 4534). In exposing the pelvic portion of the ureter it aids to have the patient placed in the Trendelenburg position. The epigastric vessels are doubly ligated and tied. The operator, with the pulp of his thumbs, continues to free and roll the peritoneum off of the pelvic structures, still working in the plane of the transversalis fascia and progressively descending toward the iliac fossa _ pushing the peritoneum toward the umbilicus, in the upper and lower part of the pelvic wound, the parts being further retracted by a large retractor (Fig. 4535). The spermatic

cord and the round ligament are encountered and displaced inward. The common iliac at its bifurcation into external and internal branches is exposed. Thence the relations of the ureter will depend upon the sex being operated upon. In the male, it is crossed above and to the inner side by the vas deferens, which intervenes between it and the bladder – and, just before entering the bladder, it passes beneath the free extremity of the vesiculæ seminales. In the female it passes down parallel with the cervix uteri and upper part of the vagina – lying about 5 mm. ($\frac{1}{2}$ inch) external to the cervix, opposite the os internum – running posteriorly to the uterine artery, through the uterine

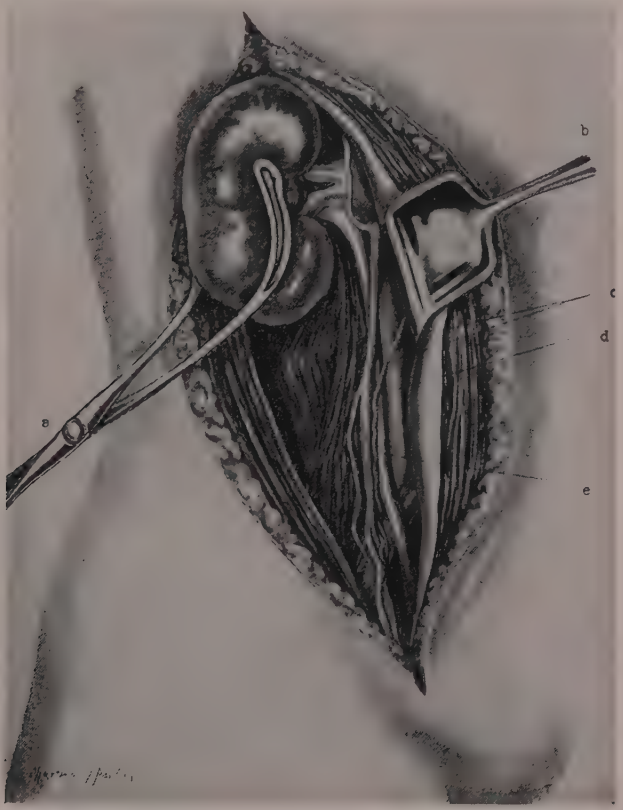


Fig. 4535.—Total Extraperitoneal Nephro-ureterectomy by an Oblique Lumbo-ilio-inguinal Incision: – **b**, The unopened peritoneum, displaced mediad; – **a**, special forceps, drawing the kidney outward, so as to expose its pedicle for ligation; – **c**, spermatic vessels; – **d**, vena cava; – **e**, ureter crossing the bifurcation of the iliac vessels.

venous plexus, and below the broad ligament – crossing the vagina opposite its upper third to the vesicovaginal interspace, and entering the bladder opposite the center of the vagina. Entering the bladder, in both sexes, the ureter passes obliquely downward and inward through its wall, emerging upon the mucous membrane about 2 cm. ($\frac{3}{4}$ inch) posterior to the meatus urinarius internus.

Upon the completion of the procedure for which the exposure was made, the long wound is closed by buried and superficial layer suturing – with or without drainage, as indicated.

Comments.—This is the most usually adopted method of exposing the ureter from kidney to bladder. It gives especially free access to the upper aspect of the ureter. In cases where, owing to limitations of working room, through shortness of the space between costal arch and iliac crest, thickness of the abdominal wall, or pathologic complications, it may be necessary to add a secondary incision running off from the main one, extending transversely, or at an angle, generally toward the median line, but sometimes posteriorly.

After incising the transversalis fascia the colon should be recognized and displaced mediad, which may be accomplished by a gauze-covered finger or a piece of bunched gauze held in long-handled forceps.

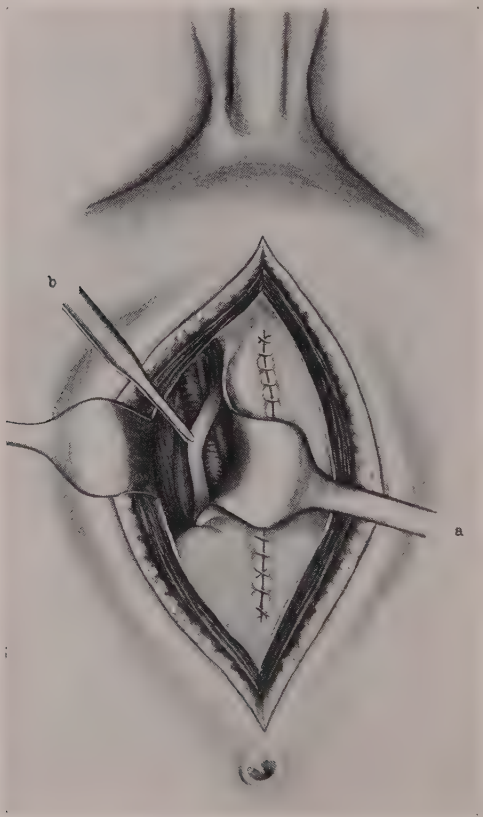


Fig. 4536.—Retroperitoneal Exposure of the Ureter, Following the Opening and Closing of the Peritoneum, in the Trendelenburg Position; Following an intra-abdominal exploratory median abdominal section, the peritoneum is sutured up and retracted mediad from the lumbar fossa, **a**, where the ureter, **b**, is exposed, as it crosses the iliac vessels.

In cases of ureteral obstruction the portion of the ureter above the obstruction is usually larger and more easily recognized.

If it be known in advance that it is the lower part of the ureter which is involved, only the lower portion of the above incision may be employed and its lower end may be given an obliquely upward and inward direction, through the abdominal muscles, to the outer border of the rectus muscle.

Correspondingly, if only the upper aspect of the ureter is sought, the lowermost part of the incision of exposure is omitted. Additions to the incision,

as originally planned, may be added to it at any time _ or a shorter initial incision may be lengthened in either direction.

The easiest method of procedure, in this long wound, is to first deepen its upper portion, through the tissues of the lumbar region, until the subperitoneal region is reached _ and thence separating the peritoneum by blunt dissection, with the finger, cut down upon the finger from without, along the lower stretch of the line of incision _ using the finger as a guide upon which to cut from without, inward, *pari passu*, with the separation of the peritoneum from the abdominal wall _ clamping, and then tying, any vessels which may bleed.

If it be difficult to locate the ureter near its beginning, practice upward and backward traction upon the kidney, and then trace the ureter downward from the renal pelvis. While the psoas muscle is the posterior rallying point for locating the ureter, it is to be remembered that in freeing the posterior parietal peritoneum, by blunt dissection, the ureter is due to be pushed forward along with the peritoneum, to which it almost invariably adheres.

When the ureter is located, it should be carefully seized by a blunt hook and drawn away from the peritoneum _ not separating it from its surrounding connective tissue, in which its nutrient vessels run.

It will sometimes happen that in the course of a transperitoneal operation a condition will be discovered which will indicate the need of exposing the ureter, and the desirability of doing so retroperitoneally. Under such circumstances this may sometimes be accomplished by suturing the anterior peritoneal incision, and then proceeding to separate the peritoneum from the abdominal parietes, as just described (Fig. 4536).

PARAPERITONEAL EXPOSURE OF THE URETER

BY VERTICAL INCISION JUST OUTSIDE OF THE SEMILUNAR LINE

The principles involved here are the same as those involved in the already described paraperitoneal exposure of the kidney and, by the extension of the operation, also of the upper aspect of the ureter.

Similarly, too, the procedure just described _ the extraperitoneal exposure of the kidney and the entire ureter by the oblique lumbo-ilio-inguinal incision _ is a paraperitoneal method of exposure _ differing merely in the manner of exposure.

In the present procedure the exposure is accomplished through a vertical incision placed about 1.2 cm. ($\frac{1}{2}$ inch) to the outer side of the semilunar line of the side of the involved ureter, beginning just under the costal arch, and passing downward to the anterior superior iliac spine.

The incision is deepened through the musculature of the anterior abdominal wall, down to, but not through, the peritoneum _ recognizing the subserous connective-tissue plane. An effort is made to preserve as many of the abdominal wall nerves as possible, although their course is crossed by the incision _ yet, by careful retraction, the upper and lower nerves can usually be spared.

As soon as the subserous fascia is reached, the parietal peritoneum is carefully separated by blunt dissection, by the tips of the fingers, from the abdominal wall and displaced inward, toward the median line _ and held there by retractors. If, during these manipulations, the peritoneum be torn, the tear is at once closed by suture before proceeding.

The details of manipulation, in connection with the delivery of the ureter into the field, are the same as in the operation last given.

Upon the completion of the special object for which the exposure is made, the wound is closed by layer suturing.

TRANSPERITONEAL EXPOSURE OF THE URETER

The transperitoneal method of exposing the ureter is usually only resorted to in cases in which either the site or the nature of the involvement – or both – are uncertain. If there be no guide as to these points, the exposure is made by the median abdominal route. If it be at least known which ureter is involved, the incision is generally made through or just to the outer side of the corresponding semilunar line.

Approached from in front, by the transperitoneal route, there are several disadvantages over the extraperitoneal method; – both the anterior and posterior parietal peritoneal layers must be divided, which may be a serious handicap in some pathologic conditions; – the ureters lie deeply placed, behind some of the abdominal organs, and in the midst of important relationships; – they may not be easily found unless markedly diseased or involved; – and drainage is difficult to provide. All of these difficulties are largely overcome in the retroperitoneal exposure.

In exposing the lumbar portion of the ureter the patient lies upon his back – and after the abdomen has been opened, the intra-abdominal viscera are displaced, by packing and retractors, away from the known course of the ureter. The kidney is the first rallying point – then the hilum – and from it the ureter is traced downward, as it lies beneath the posterior parietal peritoneum, upon the psoas muscle – until it reaches the bifurcation of the iliac artery. The upper part of the lumbar portion of the ureter is exposed more readily than the lower part of the lumbar ureter, where the important branches of the mesenteric vessels which run to the colon near the pelvic brim are apt to embarrass the field – which is not the case in exposing this portion of the ureter extraperitoneally.

In exposing the pelvic portion of the right ureter the patient is best placed in the Trendelenburg position – and the intestinal coils held upward and inward by compresses and retractors. In this part of the work first locate the sacral promontory – about 3.8 cm. ($1\frac{1}{2}$ inches) to the outer side of which lies the common iliac bifurcation – the ureter crossing the external iliac just to the outer side of the bifurcation – with the spermatic vessels running downward just external to the ureter. The posterior peritoneum is incised to one side of the ureter – and the margins of the peritoneal incision retracted to expose the ureter.

In exposing the pelvic portion of the left ureter the loop of the pelvic colon is displaced outward – and the inner layer of the mesocolon is transversely incised on a level with the sacral promontory – exposing the ureter as it crosses the common iliac artery, just proximal to the bifurcation.

The indicated technical procedure is carried out upon the ureter – and the abdomen closed as usual – with or without drainage, as indicated.

OTHER METHODS OF EXPOSING THE URETERS

Exposure of the Ureter by the Vaginal Route.—This method of approach has been resorted to in some cases of ureteral calculus, where the stone has been impacted close to the bladder and within reach from the vagina – and in cases of ureterovaginal fistulæ.

Exposure of the Ureter by the Transvesical Route.—A ureteral calculus which has become impacted within the vesical portion of the ureter, or in immediate relation with the bladder, can often be best removed through a median abdominal wound, followed by an extraperitoneal median cystotomy – after which the vesical orifice of the ureter is cut through – or sometimes the adhesions which have formed in direct connection with the calculus,

will enable an incision to be made directly through the immediately adjacent and adherent bladder and ureter walls. At the end of the operation the bladder wound at the ureteral orifice is repaired by suture, leaving a normal exit for urine.

Exposure of the Ureter by the Sacral Route.—In twice operating for a calculus impacted 6.3 cm. ($2\frac{1}{2}$ inches) from the vesical orifice of the ureter, Sir Henry Morris made a straight incision of 12.7 cm. (5 inches), beginning 5 cm. (2 inches) above the margin of the gluteus maximus muscle, reaching downward nearly to the level of the anus, and dividing the borders of the gluteus maximus and great sciatic ligament. The fatty areolar tissue of the pelvic wall was broken through by combined blunt and sharp dissection – the rectum and vagina pushed to the opposite side – and the ureter exposed.

The ureter has also been exposed through the perineum (Fenwick) – and through the rectum (Ceci).

URETERAL CATHETERIZATION AND EXAMINATION IN THE MALE

Description.—The passage, by means of exposure through a cystoscope, of a ureteral catheter – through the vesical orifice of the ureter, along the course of the ureter, into the renal pelvis. A single ureter may be catheterized at a time, or each in succession, or both simultaneously (by means of a double catheterizing cystoscope).

Ureteral catheterization is one of the final applications of cystoscopy. As, therefore cystoscopy is a preliminary step to the passage of a ureteral catheter, or bougie – either for the separate collection or segregation of the urines from the two kidneys, or of a ureteral bougie for examination of a ureteral stricture, or calculus – the technic of cystoscopy should be first mastered – and for the description and illustrations covering this subject see Index.

In the present instance it will be supposed that the preliminary details of cystoscopy have been obtained from the above reference.

Technic of Ureteral Catheterization in the Male.—One of the forms of double catheterizing cystoscopes, which may be equipped with irrigating tube, is generally employed. On the other hand, some Surgeons prefer to use a single catheterizing cystoscope (because of the greater ease of introduction) – in which case the differentiation of the urines is accomplished by catheterizing the two ureters in turn. Again, some single channel cystoscopes are so constructed that a second catheter can be passed after displacing the first one from the channel. If the ordinary double catheterizing cystoscope can be passed, it is the preferable instrument.

With the patient prepared for cystoscopy, and having introduced the cystoscope into the bladder, armed with its lubricated catheters, the ends projecting from the ocular end of the instrument being carefully kept sterile in a towel, and the light turned on, the vesical orifices of the ureters are sought through the cystoscopic telescope. These generally lie about 2.5 cm. (1 inch) beyond the vesical ending of the urethra, at the upper angles of the trigone of the bladder, and at about 1.9 cm. ($\frac{3}{4}$ inch) to each side of the middle line – presenting the form of little linear slits, or depressed dimples, sometimes surmounting papillæ, from which small jets of urine escape at intervals. Variations from the averages, both anatomic and pathologic, must be remembered in seeking the bladder openings of the ureters.

Having located the mouth of one of the ureters, the vesical end of the instrument is so manipulated as to bring as near to the ureteral orifice as possible the aspect of the cystoscope from which the catheter makes its exit into the bladder. The catheter is then threaded through the instrument,

with its tip directed first toward and then into the ureteral orifice _ and is thence pushed or fed on up along the course of the ureter as far as may be indicated in the particular case. It may only be required to differentiate the urines, and the catheter need not be carried further into the ureters than 7.5 to 10 cm. (3–4 inches). If ureteral calculus be sought, the catheter or bougie is carried on up until the stone is encountered _ or until the pelvis of the kidney or a renal calix is entered.

Having completed the examination of one ureter, the examination of the opposite ureter is conducted in the same manner.

In the case of catheterizing the ureters for the differentiation of the urines, after the two catheters have been carried into their respective ureters (the catheter for the right ureter being one color, and that for the left another, or the right marked R., and the left L.), and the collection from each made into its own test-tube, some of the fluid within the bladder is allowed to escape by turning the stop-cock of the irrigating tube, the illuminating lamp is put out, and as the cystoscope is withdrawn _ the catheters being carefully held in the

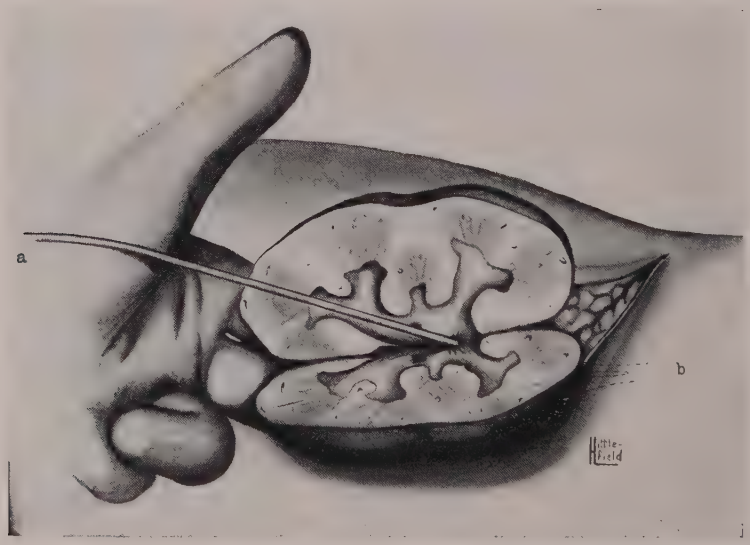


Fig. 4537.—Bisection of the Kidney, Followed by Retrograde Catheterization of the Ureter for Exploration.

ureters. The catheters are left *in situ* a half-hour or more _ carefully protecting their outer ends from infection, and discarding the first part of the urine evacuated.

In the case of conducting an examination by bougie for stone, for stricture, or for other purpose, a solid bougie or hollow catheter may be employed _ and the general method of manipulation is as just described _ with the necessary modification of detail suggested by the special condition or the suspected pathology.

Comment.—Examination of the course of the ureter is sometimes accomplished in a retrograde manner _ either in those cases in which the kidney has been completely bisected, or where the renal pelvis has been sufficiently exposed and incised. The ureteral bougie, or a wax-tipped ureteral catheter is passed into the pelvis, while the kidney is supported by the fingers of the

opposite hand _ the instrument then being passed on down the ureter until its progress is arrested or the bladder entered (Fig. 4537).

URETERAL CATHETERIZATION AND EXAMINATION IN THE FEMALE

KELLY'S TECHNIC WITH OPEN-AIR CYSTOSCOPE

Description.—In catheterizing the female ureters the catheter is passed, as in the male, through some form of cystoscope _ but, owing to the shortness and patulousness of the urethra in the female, in the technic here under consideration, the ureters are catheterized under direct observation through a simple, funnel-shaped type of cystoscope with the patient in position of marked elevation of the pelvis, in either dorsal or lateral decubitus, or in the knee-chest posture.

The female ureters may also be catheterized through a cystoscope of the same general type as used in the male, but of simpler structure. The female bladder offers much less resistance to distention, by either water or air, than does the male bladder, in cystoscopy.

What has been said under ureteral catheterization in the male applies equally in the female _ namely, that ureteral catheterization is one of the final applications of cystoscopy (see Index) _ which should be understood and mastered as a preliminary to examination of the ureters by catheter or ureter.

Technic of Ureteral Catheterization in the Female by the Aërocystoscopic Method, or Open-air Cystoscope.—The principles involved in this technic are the following: _ the pelvis must be elevated, which is accomplished in either the knee-chest posture (the most desirable), the elevated dorsal, or the elevated lateral; _ the vagina is allowed to become distended with air by separating the vaginal lips, thus letting the anterior wall of the bladder drop forward into a better plane for visual examination; _ the distention of the bladder by air, accomplished by posture and the opening of the urethra (as the vagina is distended by air in the Sims position); _ and the final examination of the bladder and localization of the vesical orifices of the ureters through a straight, open cystoscope, unaided by lenses _ under direct illumination from a head light, or under illumination of an electric light introduced into the bladder.

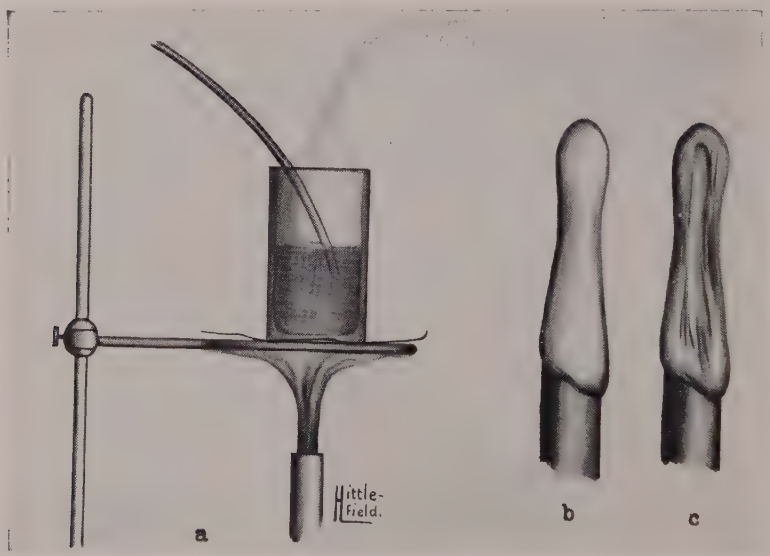
Having placed the patient in position _ analgesized the urethra with 10 per cent. cocain solution _ dilated the urethra _ inserted the cystoscope _ removed the urine by suction drainage _ examined the bladder in general _ and located the ureters _ all of which is explained under Cystoscopy in the Female (q. v.) _ the special technic of catheterizing the ureters is begun.

The localization of the ureteral orifices is, naturally, the rallying point of the technic. They are best found after introducing the speculum through the urethra, by then carefully withdrawing the cystoscope until the vesical orifice of the urethra is recognized _ and, with this anatomic landmark localized, to again carefully advance the cystoscope, directing it from 20 to 30 degrees to right or left, carefully watching as advancing toward the base of the bladder. While carefully going over this field, one seeks for some little slit, or depression, or marking different from the rest of the field, which if discovered within the usual area, is likely to prove the ureteral orifice _ and whose presence is positively verified by a little jet of urine at intervals of a few seconds. If in doubt, a bent-handled ureteral sound or searcher carried through the cystoscope, and made to enter the orifice, will clear up the doubt. If the ureter first sought cannot be at once discovered, seek the opposite one, and then, with this accurate anatomic datum, again seek the original orifice. If the urine have

been previously colored with indigocarmin the vesical orifice of the ureter will be colored by it, thereby leading to its localization.

Having located the bladder mouth of the ureter, whether by catheter or by sound, the ureteral catheter is passed on up the course of the ureter, into the pelvis of kidney, in the same way as described in the catheterization of the male ureter _ the technic being the same after the vesical orifice of the ureter is once entered.

It often happens that the ureteral catheter is too flexible to be passed along the ureter by means of its own structure _ in which case a copper stylet is introduced its entire length. Care is taken to keep the stylet from projecting from the end of the catheter during the act of introduction. The stylet may be withdrawn as soon as the catheter is in satisfactory position _ and must be withdrawn if urine be sought.



Figs. 4538–4540.—Waxing the Ends of Ureteral Exploratory Bougies or Catheters: _ a, Catheter dipped in melted wax; _ b, wax-tipped catheter, coated and ready for use; _ c, the same, after having been used in exploring for ureteral stone, and showing the stone scratches upon the waxed tip. (The parts of the picture are not drawn to scale.)

In order to make the ureteral catheter also serve the rôle of a stone detector its tip distal to, but not including the eye, is dipped into a mixture of dental wax (Fig. 4538), melted in an equal amount of olive oil _ this soon dries _ and, if it encounters a stone, is scratched by it (the scratches being recognized under a magnifying glass _ Figs. 4539 and 4541).

In the introduction of the ureteral catheter, after the ureteral orifice is demonstrated in the field of the cystoscope, the Surgeon kneels or sits, and takes the catheter between the first three fingers of his right hand, for the left ureter _ and in the first three fingers of the left hand, for the right ureter _ and, steadying its end upon the outer border of the cylinder of the cystoscope, he then carries it through the cylinder, without touching its sides, and on into the mouth of the ureter, which lies located within the field. Having engaged its end in the orifice of the ureter, he pushes the instrument into the ureter for 3 or 4 cm. ($1\frac{1}{4}$ or $1\frac{1}{2}$ inches). It is desirable to carry the catheter

along the course of the ureter by a steady, onward, and not by a back-and-forth fluctuating movement. When the catheter is once well engaged within the ureter the distal end of the instrument, which projects beyond the outer end of the cystoscope, and which, in this special technic has had placed upon it, prior to sterilization, a little rubber cuff, or sleeve, about 3 cm. ($1\frac{3}{16}$ inch)



Fig. 4541.—Catheterization of the Female Ureters Through Kelly's Open-air Cystoscope (Diagrammatic); – Upon the right side a wax-tipped catheter is encountering a stone, which is scarring its end, in the renal pelvis; – Upon the left the sound is engaged in a tubercular stricture of the ureter.

in length, projecting beyond the end of the catheter, is seized by this rubber cuff by the teeth of the Surgeon (to keep the course of the long catheter straight) – and, while thus engaged in the ureter, at one end, and steadied by the teeth, at the opposite end, the instrument is carefully fed on into the ureter. The Operator removes the rubber glove when about 20 cm. (8 inches) of the catheter has been passed on into the ureter – so that his tactile sense will be better

while completing the catheterization, requiring as it does the most delicate sense of recognition when the instrument encounters an almost imperceptible resistance, as it touches the top of the renal pelvis.

If the stylet have been used in the catheter, it is now withdrawn. But if the stylet have not been used, and it is desired to catheterize the opposite ureter, the stylet may be carried up through the catheter until the end of the stylet enters the ureter, then while steadying the catheter which is in position – so that it will not be displaced while withdrawing the cystoscope – the cystoscope is withdrawn, leaving the catheter in position. The same or, better, the next smaller size cystoscope is then introduced – in such a way that the already introduced catheter will lie between the cylinder of the second cystoscope and the wall of the urethra. The orifice of the second ureter, having been located in the earlier examination, is now exposed in the field of the cystoscope – and catheterized in the same manner as the first – after which both catheters are steadied in position while the cystoscope is being withdrawn.

Finally, if it be the object to collect differentiated urines from the two kidneys, the patient, if in the knee-chest posture, is helped into a comfortable position – the rubber sleeves which were on the ends of the catheters and which were grasped by the teeth are withdrawn – and the sterile ends of the catheters placed into the ends of two sterile test-tubes, plugged with sterile cotton, and held in special supports.

Comments.—The vesical orifices of the ureters are apt to prove difficult to find because of having advanced the cystoscope too far in the direction of the fundus of the bladder (the commonest error) after passing the vesical orifice of the urethra – and must, therefore, be somewhat withdrawn, as the instrument itself is hiding the orifices.

The ureteral catheters are best sterilized, with little rubber sleeve attached, wrapt in a towel, in an autoclave – and, when used, lubricated with some sterile neutral, non-oily material.

The best ureteral catheters are of woven silk, covered with shellac – and stand a number of sterilizations.

The ureters may be also catheterized through the ordinary types of catheterizing cystoscopes (see Operations Upon the Bladder).

LAVAGE OF THE URETER AND RENAL PELVIS

The surgical position of irrigation of the renal pelvis and ureter is as yet not settled by general consensus. Cases are on record in which obstinate pyelitis has been cured by irrigating with various antiseptic solutions.

A ureteral catheter is carried up through the ureter, to the renal pelvis, by the aid of cystoscopy – after which the irrigating fluid is carefully delivered into the renal pelvis by means of a ureteric catheter syringe, at the rate of from 30 to 60 minims delivered and allowed to escape before throwing in the same amount again.

The solutions usually employed are the following: – 1:8000 boric acid solution, – 1:1000 protargol solution, – silver nitrate solution, beginning with 1:500 solution, and running up, subsequently, to 2 per cent. or even 5 per cent. (the stronger solutions causing considerable pain).

Geraghty, who advocates stronger silver nitrate solutions in these lavages, only employs them where the renal pelvis has been shown, by pyelography, to be normal, and in cases where there is a normal phenolsuphonephthalein test.

URETERAL AND RENAL DRAINAGE

It has been observed that severe colic caused by the passage of a small stone, and even blood-clots, through the ureter, is often relieved by a single passage of the ureteral catheter.

The employment of the retained ureteral catheter has proved useful in some cases of acute renal infection, and in some retrograde chronic renal cases not open to operation.

Albarran used a rather large ureteral catheter, which he allowed to remain in position for ten days _ after which he passed a filiform up through the catheter in position, and through its terminal opening _ then withdrew the original catheter _ and passed up a second catheter over the same filiform for another ten days.

Others have used smaller catheters over shorter periods of time. Peck allows it to remain *in situ* for only a day or two, in connection with operation for hydronephrosis.

The presence of the catheter occasionally aggravates rather than relieves the symptoms.

A very small catheter, or a filiform will drain by capillarity.

URETEROTOMY FOR THE REMOVAL OF URETERAL CALCULUS

Description.—By ureterotomy is signified the incision of the ureter, in some part of its course _ and is performed, most frequently, for the removal of ureteral calculi. Incision of the ureter, however, may be made for some other purpose _ such as for exploration of some part of its course between kidney and bladder _ or at its cystic opening, to enlarge the orifice _ or in the course of a stricture, preliminarily to some plastic procedure _ and the like.

Ureterotomy (the term "ureterolithotomy" is, strictly, incorrect), performed for the removal of stones, will be here considered _ and later ureterotomy for strictured ureter (v. p. 441).

Calculi may be lodged at either the upper or lower end of the ureter, or in the middle _ usually at one of the two ends. Ureterotomy may be extraperitoneal or transperitoneal _ when the ureter is approached, respectively, behind the peritoneum, or through the abdominal cavity. Extraperitoneal ureterotomy is always preferable. Where the site of the ureterotomy is only determined in the course of an operation performed through one of the regular incisions, the ureterotomy will be extraperitoneal, or intraperitoneal, according to circumstances. Even when the ureterotomy is done transperitoneally, however, the site of the ureterotomy, in concluding the operation, should be as thoroughly shut off (walled off) by suturing of peritoneum around the site as possible. Extraperitoneal ureterotomy is usually performed through the oblique lumbar incision, extended as far forward and downward as necessary. Transperitoneal ureterotomy is generally done through a median abdominal incision, or one in the linea semilunaris, or just outside of it.

Preparation _ Position _ Landmarks _ Incision.—As for exposure of the kidney and ureter by either an oblique lumbar or an anterior abdominal incision.

Operation.—(*a*) In the Extraperitoneal Operation _ the ureter _ which has generally been found by tracing downward from the pelvis of the kidney (v. p. 421) _ is exposed and divided longitudinally to the necessary extent _ over the calculus, if the operation be done for that purpose (Fig. 4542) _ the ureter having been steadied and carefully incised with a small, sharp knife, aided by fine forceps _ after which the calculus is removed by scoop or forceps.

The wound in the ureter, in favorable cases, should be closed with fine silk sutures, passing through the fibrous and muscular coats. Temporary drainage should be employed in case of leakage _ the lumbar wound being closed elsewhere. (*b*) In the Transperitoneal Operation _ the ureter is exposed _ the peritoneum divided longitudinally over it _ the ureter incised in its long axis _ and the object of the operation accomplished (usually the removal of a stone). The incised ureter is generally sutured, as in the extraperitoneal operation _ and the peritoneum is then sutured over the wound in the ureter so as to render it as extraperitoneal as possible. Prior to suturing the peritoneum over the ureteral wound a posterior counteropening is made, and drainage established through this, if necessary _ the abdominal cavity being then closed.

Comments.—In freeing the ureter for incision the structure should be brought conveniently into the field _ but should not be unnecessarily bared

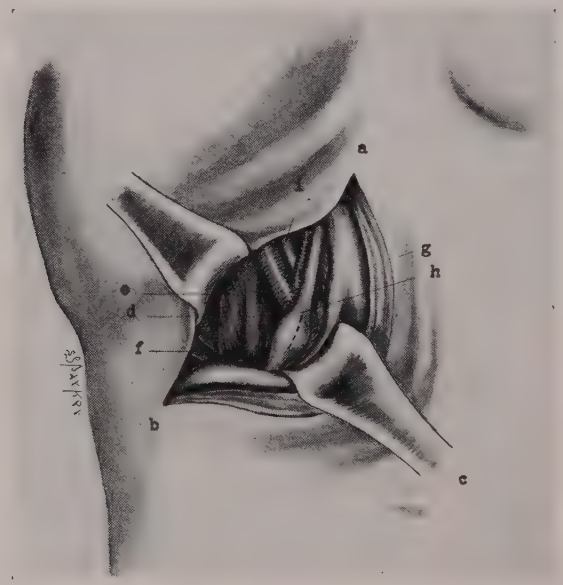


Fig. 4542.—Extraperitoneal Ureterotomy for Calculus: _ **a, b,** Oblique abdominal wound (in Trendelenburg position; _ **c,** unopened peritoneum, retracted mediad; _ **d,** psoas parvus; _ **e,** psoas major; _ **f,** lumbar nerves; _ **g,** bifurcation of the iliac arteries; _ **i,** external iliac vein; _ **h,** ureter dilated by stone _ the dotted line indicating the site to be incised, over the stone, for its removal.

of its immediately surrounding connective tissue and blood-supply further than required for the needed manipulations. The blood-vessels of the spermatic cord should also be guarded _ and in operating extraperitoneally the peritoneum should not be injured. In other words, the ureter should be operated upon while lying as much in its bed as possible _ and only as much of the length and circumference of the ureter should be freed as may be required for the manipulation.

While the incision of the ureter is usually made in the midaxis of the exposed portion, and parallel with the boundaries of the ureter, it is probably better to make a slightly oblique incision, the healing of which, after suturing, is less apt to be followed by constriction. Or, if a longitudinal incision have been made, it may be closed by transverse suturing if this be indicated (v. Fig. 4554) _ with resulting broadening of the sutured site.

In operating for calculus, if the stone can be dislodged upward or down-



Fig. 4543.—Removal of a Ureteral Calculus by Means of Forceps Introduced Through the Incised Renal Pelvis or Beginning of the Ureter.

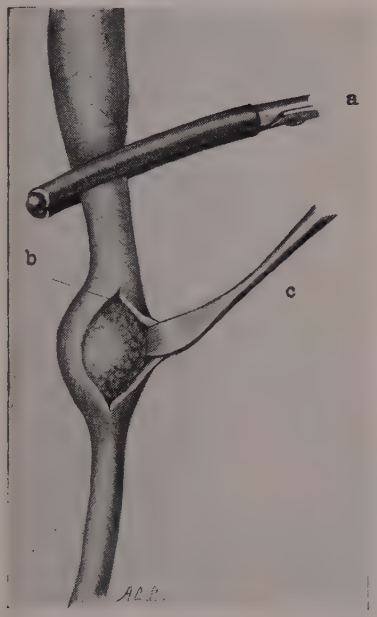


Fig. 4544.—Ureterotomy for Calculus—I:—a, Light, rubber-guarded clamp, placed above the calculus, to control leakage of urine from the kidney during operation;—b, an axial incision through the wall of the ureter, made upon the stone, as a distending form;—c, blunt elevator, levering the stone out of the lumen of the ureter.

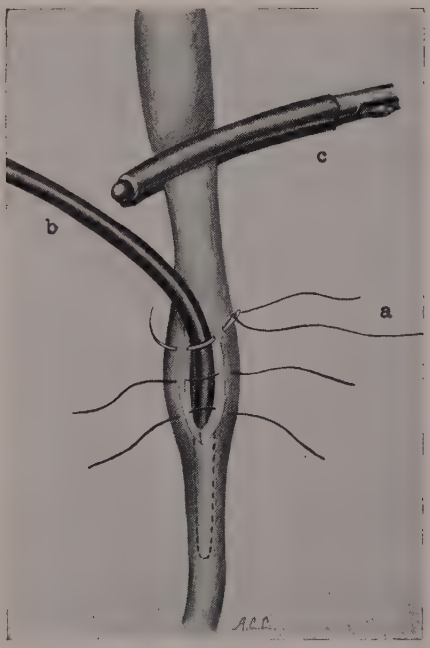


Fig. 4545.—The Same—II;—The ureteral incision is being sutured by interrupted, non-penetrating sutures, a, placed over a distending ureteral bougie, b, temporarily introduced to aid suturing;—c, clamp control of the approximate ureter.

ward, somewhat away from the site of its lodgment, the incision through the ureter, for its evacuation, can then be made through healthier tissue—than through the site damaged by the presence of the stone.

Whenever the ureter has been opened for calculus, after the stone has been removed, the proximal and distal ureter should be examined by a ureteral bougie for other possible calculi.

In the case of a calculus lodged near the renal pelvis an incision may often be made through the pelvis of the kidney, or at the junction of the pelvis with the beginning of the ureter _ followed by the introduction of delicate special, curved forceps down the ureter, whose blades are then opened and grasp the stone (Fig. 4543).

Before incising the ureter to remove the calculus _ or for any other purpose _ the ureter should be lightly clamped, proximally, to prevent the leakage of urine _ as shown at **a**, Fig. 4544.

After incising the ureter over the calculus, the stone may be somewhat difficult to dislodge _ and may either have to be seized with special forceps _ or be pried out with a delicate, curved blunt dissector (v. Fig. 4544, **c**). The subsequent suturing of such an incision, while temporarily using a distending support, is seen in Fig. 4545, **a** and **b**.

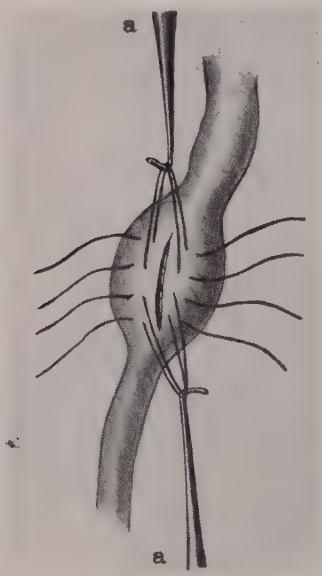


Fig. 4546.—Ureterotomy for Stone; _ The stone is first used as a support, upon which interrupted, non-penetrating sutures are placed, in Lembert fashion, across the course of the future incision. The sutures are then held apart, **a**, **a**, _ and the incision made down upon the stone. Following the removal of the calculus the sutures are tied. Ordinary sutures are generally used.

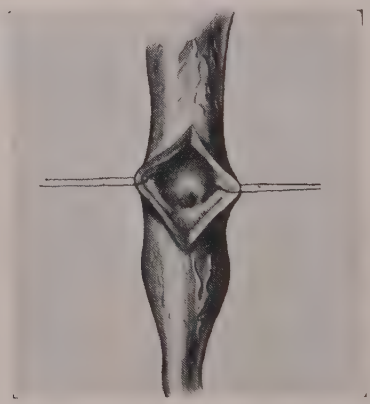


Fig. 4547.—Ureterotomy for Calculus and Stricture _ I; _ The incision in this case has been made upon the lower aspect of the distended ureter _ revealing, by probing, a narrowed lumen leading, distally, into the stone-containing part of the ureteral lumen. (Figs. 4547–4549 modified from Kelly and Burnham.)

Sometimes the stone is first used as a distending form, over which to place the sutures _ which are held apart while the incision is being made _ and are then tied (Fig. 4546).

An incision may be made over the lowermost part of the distended proximal aspect of the ureter (Fig. 4547), where it may be revealed that this distended part of the ureter is connected by a narrowed lumen with the distal part of the ureter, in the upper and immediately adjacent part of which the stone is lodged. In which case it is indicated to continue the incision on downward over the stone, and the intervening area of narrowing (Fig. 4548). The completion of this technic by suturing is seen in Fig. 4549 _ the principles of ureterorrhaphy being explained at p. 439.

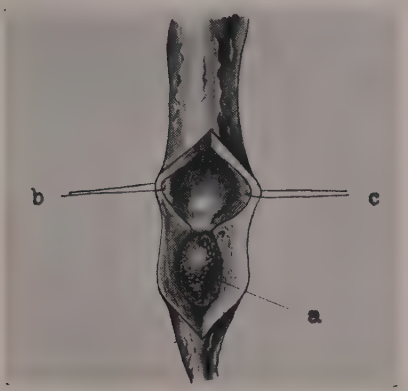


Fig. 4548.—The Same _ II; _ The incision has been extended down over the stone, a, and the stricture below it _ while the lips of the ureteral wound, b, c, are retracted.



Fig. 4549.—The Same _ III; _ Following the extraction of the stone and the mechanical dilatation of the distal part of the ureter, the margins of the ureter are brought together by non-penetrating sutures _ followed by suturing the overlying connective tissue over the site for reinforcement (the latter not here shown).



Fig. 4550.—Perineal Ureterotomy for Calculus in the Male: _ a, Bladder; _ b, prostate gland; _ c, c, incised and retracted deep fascia; _ d, retractor of vas deferens and vesicula seminalis; _ e, ureter, drawn into the wound by a hook retractor, and incised upon the contained stone.

Judgment must be used in suturing the surrounding connective tissue closely about the sutured ureter, as to whether there be danger of constriction

of the ureter in the subsequent formation of scar tissue. At the same time it is to be noted that the "atmosphere," or sheath of connective tissue, in which the ureter lies, presents a firm, resistant tissue, which may be usefully utilized in closing wounds of the ureter – in that the incised walls of the ureter can often be sufficiently approximated for union by sutures which pass through the connective tissue alone.

To make provision in the event of leakage of urine from the sutured ureter (and, in some cases, for possible infection), the question of drainage will arise – and if this arise, in the case of an extraperitoneal operation, a temporary drain may be brought out of a convenient aspect of the wound. In the case of an intraperitoneal exposure, after the peritoneum has been closed off, the

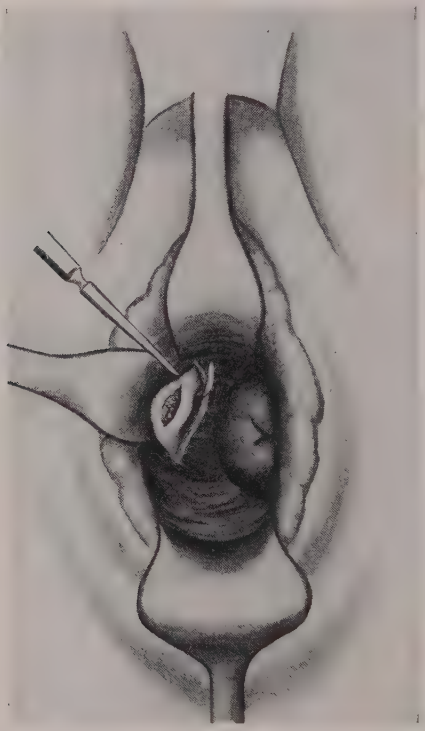


Fig. 4551.—Vaginal Exposure of the Ureter for Calculus; – Through a curved incision in the lateral aspect of the dome of the vagina a hook retractor is delivering the ureter, ready for incision over the calculus (the incision here shown completed).

temporary drain may be brought out through a counteropening. The wounds are otherwise closed down to the drains by layer suturing. It may be said that temporary drainage down to a sutured ureter is always safer – but not always necessary.

In dealing with ureteral stones encountered in some part of the pelvic portion of the ureter, the special line of procedure will be determined by the site of the stone, the surrounding relations, and the sex of the patient – and must be planned in accordance. The field of operation is often exposed by an incision in, or just outside of, and parallel with, the right or left semilunar line – or through McBurney's point and parallel with Poupart's ligament. The ureter is exposed as it crosses the iliac crest, and then followed on down to the site of involvement.

In operating upon a ureteral calculus near the bladder, in the male, a perineal incision may be the most direct method of approach _ incising the superficial and deep perineal structures _ retracting the vas deferens and vesicula seminalis _ and exposing and incising the ureter over the stone (Fig. 4550).

In operating upon the female, for a calculus near the bladder, the exposure is sometimes most conveniently made through the dome of the vagina (Fig. 4551).

A stone lodged in the vesical portion of the ureter is sometimes more easily removed through a transvescial exposure than in any other way.

The details of suturing a ureterotomy wound will be next considered.

URETERORRHAPHY FOR INCISIONS OR WOUNDS OF THE URETERS

Description.—Suturing of the ureters is most frequently performed under the following conditions: _ for the closure of incisions of the ureters made for the extraction of stones, _ for the closure of wounds (whether made from without or, accidentally, by the Surgeon), _ in connection with ureteroplastic operations (as, for instance, for the relief of strictures of the ureters), _ in the performance of anastomoses of some part of the ureter to another part of the ureter, or to some other hollow viscus, _ and the like.

The suturing of incisions made for the removal of calculi, and of wounds of the ureters, will be here considered _ while other phases of ureteral suturing will be considered under their technical headings.

The incisions made for the removal of calculi _ as well as ureterotomy in general _ have been considered at p. 433.

The varieties of ureteral wounds encountered are the following: _ longitudinal; oblique, complete and incomplete; transverse, complete and incomplete. The ureters are so protected as to be rarely lacerated, except by extensively disorganizing injuries.

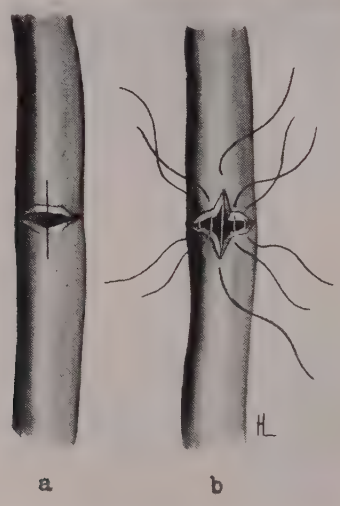
Preparation _ Position _ Landmarks _ Incision.—Determined by the special operation in connection with which the suturing of the ureters is indicated.

Operation.—Ureterorrhaphy is usually performed with fine silk, carried upon a fine French or intestinal curved needle, held in a holder _ the stitches traversing the outer coats, fibrous and muscular, without penetrating the innermost, or mucous, coat. From many standpoints fine catgut is preferable, No. 00 _ and is frequently used. Even with this, one attempts to avoid the mucous coat _ but its penetration by an absorbable suture is of less consequence than penetration by a non-absorbable one. Ordinarily placed, interrupted sutures appear to be the best _ about 3 mm. ($\frac{1}{8}$ inch) apart _ though simple continuous sutures _ and modified forms of continuous sutures sometimes are employed. If there be sufficient excess of ureteral wall, as in operating over the portion of a ureter bulged out by a contained stone, the Lembert type of sutures passing through the fibrous and part of the muscular coats is sometimes employed _ union then occurring between the surfaces rather than the margins of the fibrous coats of the ureter (v. Fig. 4557), these coats having been rendered raw in exposing the ureter, and union taking place by the growth of the connective tissue of the apposed surfaces.

The margins of surgically made ureteral wounds tend, naturally, to lie in contact, thus lending themselves to accuracy in further apposition by suture. The individual lips are steadied by delicate forceps during the passage of sutures. The method of placing sutures in the lips of incisions made into the ureter for the removal of stones has been illustrated in Fig. 4546. Re-

inforcement of the first row of sutures by a second row is not to be carried out, owing to the tendency of narrowing the lumen _ unless there be considerable excess of ureteral wall, as in the bulged-out area previously occupied by a stone. Reference has also been made under Ureterotomy, p. 434, against the possibility of also constricting the site of suture by the contraction following the too tight suturing of connective tissue around the ureter proper for the purpose of preventing leakage. The peritoneum can often be made use of to suture over, but not around, the site of the sutured ureter. The proximal portion of the ureter should always be lightly clamped, in advance of suturing, to prevent urinary leakage.

Axial wounds of the ureters, made in dilated portions of the ureters, as over stones, may be sutured by transversely running interrupted No. 00 chromic catgut sutures _ as illustrated under ureterotomy (v. pp. 434–435).



Figs. 4552 and 4553.—Ureterorrhaphy for Transverse Wound of the Ureter: _ a, A short axial incision is made through the ureteral wall, crossing the transverse tear at a right angle; _ b, the wound is so sutured by non-penetrating axial sutures as to rather increase than decrease the lumen of the ureter at the involved site.

Axial wounds of the ureters of normal caliber are best sutured by interrupted sutures carried through the outer coats of the wound in an axial direction (as in Fig. 4554) _ but tied in such manner as to approximate the margins of the wound transversely, and thus secure additional width of lumen at the site of suture as in Fig. 4555.

Transverse and oblique wounds of the ureters may be sutured in the following manner to prevent in-folding and narrowing at the site of suture. A short axial incision is made through the center of each side of the transverse or oblique wound (Fig. 4552, **a**) _ after which sutures are placed axially (Fig. 4553, **b**), in such manner that when they are tied the transverse suture line will have gained, in lateral extent, the equivalent of the short axial incision.

The method just described may possibly be improved upon in the following way: _ Divide the upper lip of the transverse wound in its center, axially, upward for a short distance. Similarly divide the lower lip of the wound in its center, axially, a short distance downward. Then round off the four

corners thus formed with curved scissors, while each corner is held with forceps _ after which suture the borders as in elbowing the intestine, securing a modified stove-pipe junction effect.

In some instances ureteral wounds may be of such a nature as to indicate the desirability of completing the entire division of the structure, and then follow this by the reunion of the ends by suture (v. uretero-ureterostomy, p. 443).

Or a ureteral wound may be of such a nature, in an extreme case, as to admit neither of being repaired by suturing _ nor of anastomosis with itself or the opposite ureter. In such cases the corresponding kidney must be removed _ or the severed proximal end of the ureter must be anchored into (anastomosed with) some hollow viscus or be implanted upon the skin.

OPERATIONS FOR URETERAL STRICTURE, IN GENERAL

Definitions.—In stricture of the ureter the lumen of the ureter is narrowed at the site of stricture _ and the wall is generally thickened, from the pathologic state which causes the constriction. A stricture necessarily constitutes some degree of obstruction _ which may become total. Ureteral obstruction, however, may exist without any degree of constriction _ and is simply an impediment to the downward flow of urine from the kidney to the bladder _ the flow being either partially, or completely blocked. A stone may partly or entirely obstruct a ureter, which is not constricted. On the other hand, a tubercularly involved ureter may first constrict the ureter by narrowing its lumen _ until the disease becomes a source of obstruction.

Causes of Ureteral Stricture.—Contraction following ulceration of the ureter as the result of ureteral calculus _ constriction resulting from chronic pyogenic pyelonephritis _ syphilis _ gonorrhea _ tuberculosis _ tumors of the ureter, primary and secondary _ ureteral infection resulting in infiltration _ congenital errors _ traumatism. The ureter may be compressed by adjacent tumors and pathologic processes. Stricture of the ureter is frequently bilateral.

Operative Treatment of Ureteral Stricture.—Ureteral dilatation (v. p. 441) _ ureteroplasty (v. p. 442) _ resection of the ureter, following by uretero-ureterostomy (v. p. 443), or by implantation of the ureter into the renal pelvis (v. p. 457), or into the bladder (v. p. 457), or into the large intestine (v. p. 464), or into the skin (v. p. 475).

Treatment by simple dilatation, in those cases in which it will suffice, is desirable. Of the operative measures, excision of the site of stricture followed by uretero-ureterostomy is preferable.

DILATATION OF THE URETER FOR URETERAL STRICTURE

Description.—Simple dilatation of ureteral stricture, through the vesical orifice of the ureter, may be intermittent _ or continuous _ dependent upon whether the dilating bougie be inserted for short periods, at intervals, or whether it be allowed to remain *in situ* for a single prolonged length of time. Retrograde dilatation of the ureter is also sometimes practised.

Simple Intermittent Dilation of Ureteral Stricture Through the Bladder.—To carry out any method of ureteral dilatation from the bladder orifice of the ureter involves the application of both the principles of cystoscopy (v. pp. 507 and 520), and also of ureteral catheterization (v. pp. 427 and 432) _ for the technic of passing a ureteral bougie, or sound, is the same as that of passing a ureteral catheter. The procedure is, naturally, much easier in the female.

In the male dilatation of the ureter offers greater natural difficulties,

but, in all essential respects, is conducted in the same manner as described in the catheterization of the ureter in the male. Variously formed dilating bougies are in use.

No séance should be conducted during acute inflammatory or infective processes.

Patience and care are often required in carrying the bougie, which may be nothing more than a filiform, past the site of stricture – and, at times, it will only be possible to at first engage it in the vesical end of the strictured portion of the ureter, and by degrees, at subsequent sittings, succeed in passing it entirely through the entire length of the stricture.

In the female no different principles are involved, but the mechanical steps are simpler – especially through the open-air speculum. The manipulations, after the ureter is entered, are the same in both sexes – but, owing to the more direct and shorter route from urethra to kidney in the female, a somewhat different set of dilating instruments may be employed – especially is this so of the angulated metallic searcher, which is often so useful in difficult cases, in preceding the pliable bougie.

Several whalebone filiforms are often used simultaneously – three or four – just as in tight urethral strictures. Filiforms or bougies with corkscrew tips are also useful.

Continuous Ureteral Dilatation for Stricture.—The method of allowing a dilating bougie to remain engaged in a ureteral stricture, into, or through which it has been passed – for the purpose of maintaining dilatation for some prolonged length of time – is a method sometimes employed – though less frequently than intermittent dilatation.

Retrograde Ureteral Dilatation for Ureteral Stricture.—This may be practised in several ways – and is always secondary to some major operation – that is, is not undertaken as a sole technic in itself.

If the kidney happen to have been bisected, or the renal pelvis opened in the course of some other operation, a bougie may be passed down the ureter from the kidney – or from the opening in the pelvis.

In other instances retrograde dilatation of the strictured ureter has been carried out by exposing the ureter extraperitoneally, and then incising the ureter just above the stricture, in its dilated portion – and then, after the removal of a calculus which may be the source of trouble, or in a case of stricture of other pathology, a dilating bougie is passed downward, toward the bladder, through the constricted portion of the ureter – changing from smaller to larger sizes of instruments, as the caliber of the stricture is increased under dilatation.

The incised ureter is finally closed with catgut suturing – and a temporary drain carried down to the site of suturing.

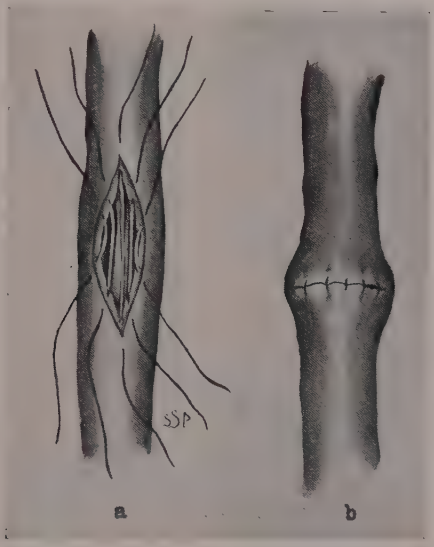
URETEROPLASTY FOR STRICTURE OF THE URETER

Description.—It is often possible to widen the caliber of a ureteral stricture by applying the method adopted in pyloroplasty for stricture of the pylorus – by incising the stricture axially, and closing the ureteral cut by a series of sutures which, when knotted, will run transversely.

Operation.—The narrowed portion of the ureter may be represented by an ordinary constriction – down the midaxis of which an incision is made through the presenting wall of the ureter – reaching, above and below, into the non-strictured portion. Axially running, non-penetrating sutures of No. 00 chromic catgut are then so placed through the apices of the incision, and equidistantly to either side of the ends (Fig. 4554, a), that, when tied, they will

constitute a transverse line of knots, and correspondingly increase the lumen of the ureter at the site of former constriction (Fig. 4555, **b**).

Sometimes a small axial incision is made above or below the strictured site, especially when the stricture is marked and the ureter so small in size as to be difficult to handle _ and through this opening a bougie is passed into the lumen of the ureter and through the site of stricture _ and upon this the strictured wall is cut through. This strictured site is then sutured as just described _ and, when that is accomplished, the small opening in the sound part of the ureter is closed by suture.



Figs. 4554 and 4555.—Ureteroplasty for Stricture of the Ureter: _ **a,** Axially placed, non-penetrating sutures; _ **b,** the suture tied, thereby widening the site of former stricture.

Ureteroplasty may be impossible if the wall of the ureter be much thickened and infiltrated _ and, in such cases, it may be necessary to divide the ureter and perform some type of uretero-ureterostomy _ or some method of ureteral implantation.

URETERO-URETEROSTOMY (URETERO-URETERAL ANASTOMOSIS—URETERO-URETERAL IMPLANTATION)

Description.—These various expressions signify the surgical union of one part of the ureter with another part of the same, or of the opposite ureter. This junction is usually brought about by suturing, applied with or without the temporary aid of distending support during the act of suturing.

The chief indication for uretero-ureterostomy is to be found in cases of wounds of the ureter which are accompanied by no loss, or very little loss of ureteral substance. The technic may also find field of application in some pathologic cases where it is necessary to divide the ureter, or excise a very small length of ureteral structure _ where the ends still remain in near enough relationship to admit of anastomosis.

Preparation _ Position _ Landmarks _ Incision.—As for the deliberate exposure of the ureter, or the condition of the ureter calling for some method

of anastomosis, whether arising from traumatic, pathologic, or surgical accidental cause, may be met in the course of some operation, either extraperitoneal or transperitoneal, not originally undertaken for that direct purpose.

Operation.—The ureter will have been exposed by either the retroperitoneal route, in the manner described at p. 433 _ the field of operation being approximately as pictured in Fig. 4542. Or the exposure may be made transperitoneally _ the field then being somewhat as shown in Fig. 4556.

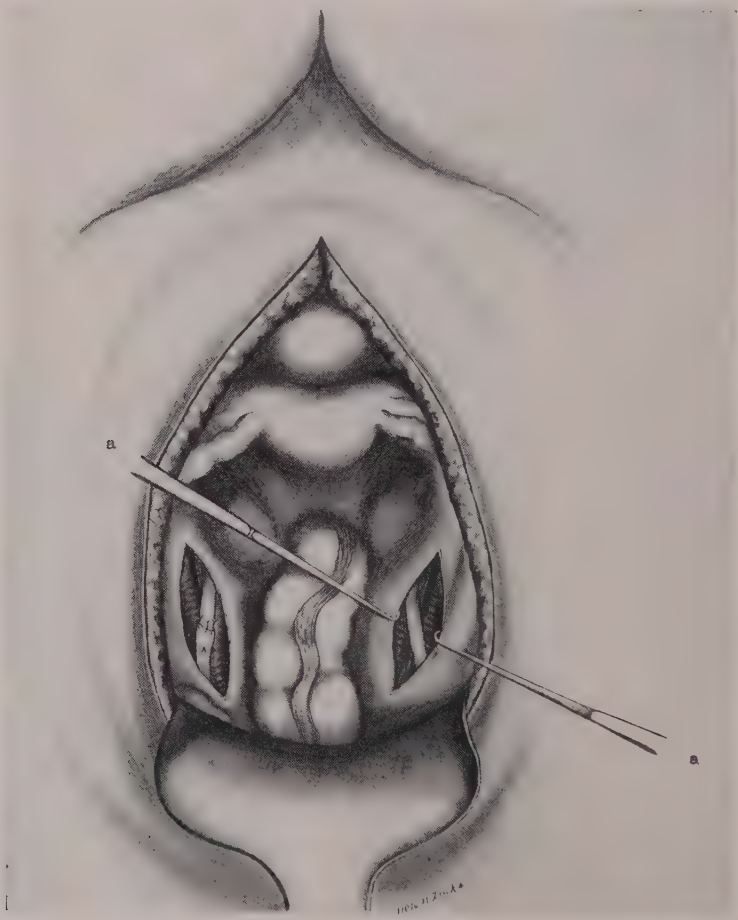


Fig. 4556.—Transperitoneal Exposure of the Ureters, Followed by End-to-end Ureteroureterostomy: _ a, a, Tractors of the incised posterior parietal peritoneum, exposing the right ureter, with the patient in the Trendelenburg position _ as the ureter crosses the bifurcation of the iliac arteries. An end-to-end uretero-ureterostomy by invagination is shown on the left side.

Methods of Uretero-ureterostomy.—Having exposed the ureter, uretero-ureteral anastomosis may be accomplished in one of a considerable number of ways _ the medium of union being by means of sutures, and the method of applying these being as described under Ureterorrhaphy. Number 00 chromic catgut is the most ideal suturing material _ and is necessary if the mucosa of the ureter is to be pierced. Fine silk, however, is usually employed _ with which one should undertake to avoid penetrating the mucosa _ the

stitches passing through the fibrous and into the muscular coats. A fine curved needle, held in a holder, is convenient.

The chief methods of uretero-ureteral anastomosis will be here considered: _

1. **Transverse, or Oblique End-to-end Uretero-ureterostomy, of Completely Divided Ends by Suturing Without Support** _ Schopf, Cushing, and others (Fig. 4557).—The ureteral ends are brought together and held in contact, while the free ends of the walls are sutured together with fine silk, in small, fully curved needle, held in a holder _ the sutures passing through the free edges of the fibrous and muscular coats of the divided ends, crossing the edges at right angles.

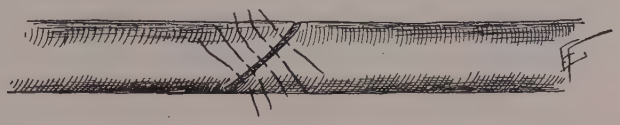


Fig. 4557.—Transverse, or Oblique End-to-end Uretero-ureterostomy, by Suturing, Without Support (Schoff, Cushing, and others); _ The obliquely divided ureter is seen sutured with interrupted Lembert sutures passed through the outer coats. Lembert sutures are here shown. Simple sutures are better.

2. **Uretero-ureterostomy by "Elbowing," Following Incomplete Division** _ Van Hook.—Make an axial incision extending from the center of each lip of the transverse wound, upward and downward, each for a distance equal to the transverse diameter of the ureter. The sharp angles (that is, the four corners) are then rounded off with scissors, thus making an ovoid opening _ and the lips of the wound are then sutured together by stitches placed axially so as to widen the site of suturing when tied, and avoid subsequent stricture. This is, practically, a ureteroplasty.

3. **Transverse or Oblique End-to-end Uretero-ureterostomy, of Completely Divided Ends, by Suturing Upon a Temporarily Introduced Bougie or Catheter** _ Tuffier (Fig. 4558).—The divided ends are brought together over a segment of a ureteral bougie, which is tied in the middle with silk (for withdrawal), and the ends of which are carried, proximally and distally, a short way into the opposite aspects of the divided ureter. The ends

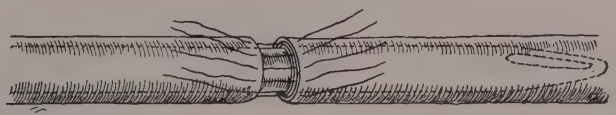


Fig. 4558.—End-to-end Uretero-ureterostomy, with Support; _ Ureteral catheter is seen within the ureter, over which interrupted sutures are passed through the outer coats of the ureter.

of the ureter are then sutured as in the last described method _ to the extent, at least, of placing the sutures _ after which the portion of bougie is withdrawn, and the sutures are tied. Sometimes the sutures are tied with the part of the bougie still *in situ* _ and then a very small, axial incision is made through the wall of the ureter opposite the distal (smooth) end of the bougie, and the support withdrawn _ followed by the suturing of the incised ureter.

4. **Transverse, or Oblique End-to-end Uretero-ureterostomy, by Suturing Upon a Special Anastomosis Sound** _ Kelly.—A special type of angular, metallic sound is here employed (v. Fig. 4559). This sound is carried into the lumina of the ureteral ends through an incision made conveniently near the more accessible end of the divided ureter (Fig. 4560, **a**). It is loosely



Fig. 4559.—Kelly's Ureteral Anastomosis Bougie.

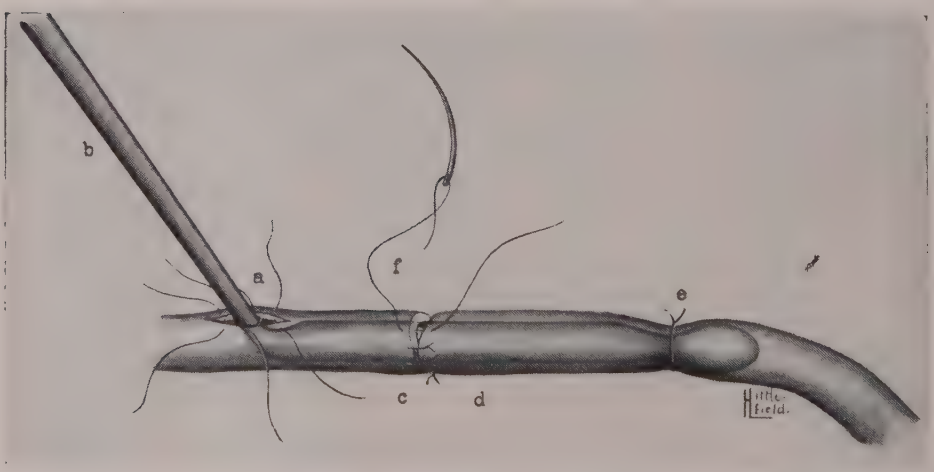
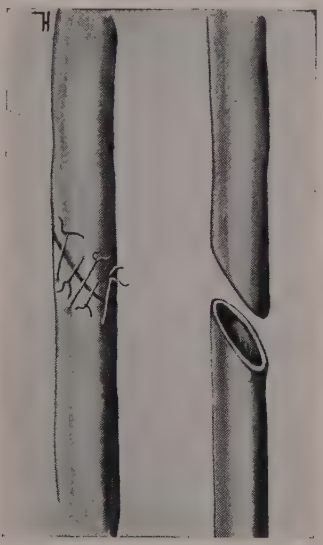


Fig. 4560.—End-to-end Uretero-ureterostomy by Means of an Anastomosis Bougie, or Sound – Kelly; – An axial incision, **a**, is made through the presenting wall of the ureter, either just above or just below the site of transverse division of the ureter. Through this the special sound, **b**, is passed – until it emerges from one cut end, **c**, and enters the other, **d** – where it is temporarily held in position by a loosely tied, non-traumatizing ligature, **e**, around the ureter, at the site of the neck of the sound. The transversely divided ureter is then united by interrupted, non-penetrating sutures, **f** – after which the sound is withdrawn – and its wound of entry into the ureter similarly closed.

and non-traumatizingly tied, temporarily, by floss silk or soft catgut carried around the ureter opposite its constricted neck (Fig. 4560, **e**) _ after which the suturing of the anastomosis is carried out in the usual manner (Fig. 4560, **f**). When the anastomosis has been completed the temporary ligature is cut _ the sound withdrawn _ and its entry incision sutured.

5. **Oblique End-to-end Uretero-ureterostomy by Suturing Without Support** _ Bovée (Figs. 4561, 4562).—To lessen the tendency to contraction, the ends are cut obliquely, if not already so divided _ then dilated with special forceps for about 2.5 cm. (1 inch) _ then approximated, without any form of support _ and sutured with fine silk, in a fully curved needle, the stitches passing through the fibrous and muscular coats only. In Bovée's technic the stitches employed are alternately rectangular (of the Cushing type) and simple interrupted. The rectangular stitch (the same as that used in enterorrhaphy) is difficult to apply in so small a structure. In the accom-



Figs. 4561 and 4562.—End-to-end Uretero-ureterostomy _ Bovée; _ The obliquely cut ends of the ureter are brought together by special suture of the Cushing right-angle type _ or, as here shown, by interrupted sutures through the outer coats, crossing the line of oblique junction at right angles with it _ and each alternate suture also serving as a relaxation suture.

panying illustration simple interrupted sutures are shown (Fig. 4562, **b**) as alternate approximation and relaxation sutures. The peritoneum is then so adjusted as to exclude the sutured ureter from the peritoneal cavity.

6. **Uretero-ureterostomy by End-into-end Invagination, With Support, Without Splitting** _ Markoe.—This method was resorted to in division of the ureter near the bladder. Two traction sutures, each threaded upon two needles, are passed through the proximal ureter near its free end, from within outward and nearly 2 mm. (about $\frac{1}{16}$ inch) apart. The needles are then made to draw the traction sutures through the wall of the distal ureter, entering in the same relative position and at the same distance apart, passing from within outward. A ureteral catheter is then passed through the distal ureter into the bladder and out of the meatus, being caught by forceps passed through the female meatus (or might be passed from the urethra, by means of a cystoscope, in the case of a male) _ the opposite end of the catheter passing into

the distal ureter. Over this the proximal ureter is invaginated into the distal, by the traction sutures _ which are then tied. Reinforcing circular suturing is used at the line of junction, passing through all the coats of the distal and through the fibrous and muscular coats of the proximal portions.

7. **Uretero-ureterostomy by End-into-end Invagination, Without Support, Without Splitting** _ Poggi.—Dilate the distal end with special for-

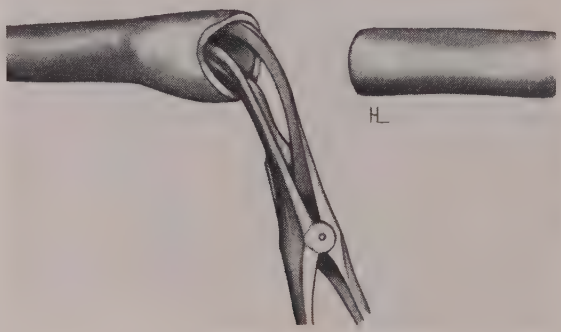


Fig. 4563.—Uretero-ureterostomy by End-into-end Invagination, Without Support, Without Splitting _ Suggested modification of Poggi's Technic _ I; _ The intussuscipiens is carefully and limitedly dilated by some form of simple bibladed or tribladed dilator of small dimensions _ (a tracheal wound dilator is here represented, though somewhat too large).

ceps _ place one (or two) pair of traction sutures through the proximal end _ two needles upon single thread, introduced nearly 2 mm. (about $\frac{1}{16}$ inch) apart, in the same horizontal plane, and about 3 mm. ($\frac{1}{8}$ inch) from within the lower end of the proximal portion of the ureter _ brought out _ and the needles passed from within outward in the distal end, the same distance apart and about 7 mm.

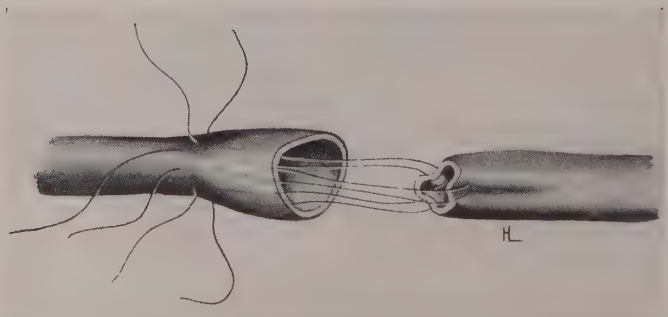


Fig. 4564.—The Same _ II; _ Three double-ended tractors are placed in the lower end of the intussusceptum, equidistantly apart _ by carrying a single-needled thread through two walls, so as to include one-sixth of the circumference of the wall between the stitches. Each limb of the three double tractors is, in turn, threaded upon a needle (or better, upon a Reverdin needle) which passes within the intussuscipiens, and out through its wall, equidistantly, on a horizontal level, just at the lower level of the dilatation. Traction upon these invaginate the intussusceptum within the intussuscipiens.

to 1.3 cm. ($\frac{1}{3}$–$\frac{1}{2}$ inch) from the free end, and opposite the points of penetra, tion above. The proximal end is then invaginated into the distal by traction- and the sutures tied. This invagination is then reinforced by a continuous or interrupted suture applied around the line of union, including all the coats of the distal and the fibrous and muscular coats of the proximal segments.

8. **Uretero-ureterostomy by End-into-end Invagination, Without Support, Without Splitting** _ Suggested simplification of Poggi's technic.—The distal end of the ureter (intussuscipiens) is dilated, as shown in Fig. 4563. Three sutures are then inserted in the manner shown in Fig. 4564 _ and whose insertion is made especially easy by the use of the Reverdin needle. These double-ended sutures first serve as tractors _ and then, as permanent anchorage sutures. In concluding the operation, interrupted sutures fix all the coats of the free edge of the intussuscipiens to the outer coats of the intussusceptum _ as seen in Fig. 4565.

9. **Uretero-ureterostomy by End-into-end Invagination, Without Support, With Splitting.**—This method, as well as the method of invagination without splitting, is credited by some to Poggi _ and by others the splitting modification is described as the Robson-Winslow method. The upper end of the distal ureter (intussuscipiens) is split _ after which a pair of traction sutures is carried through the proximal ureter (intussusceptum) _ by means of which the latter is invaginated into the former (Fig. 4566, **b**, **b**). The slit in the intussuscipiens is then sutured, and, finally, the circular line of junction may be reinforced by interrupted sutures (Fig. 4567, **c**). The suture temporarily used as a tractor is, at the end of the operation, tied as an anchorage suture.

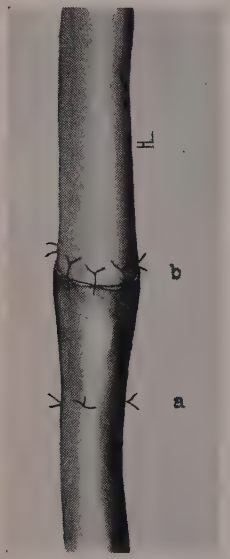
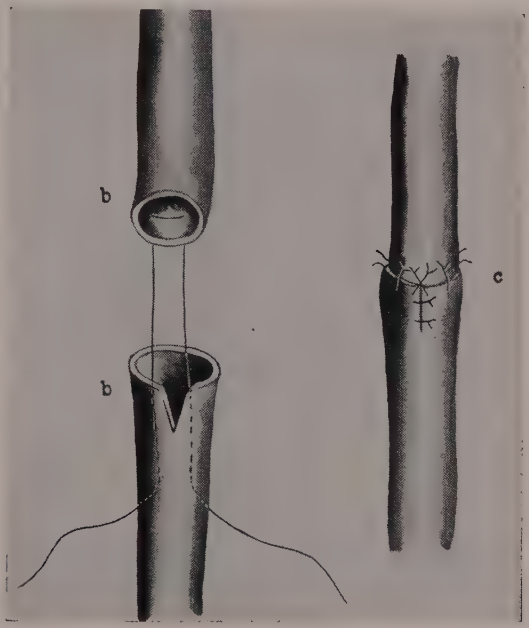


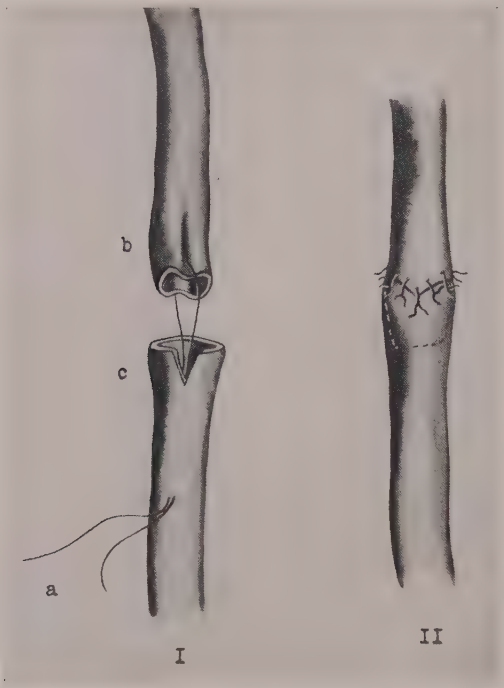
Fig. 4565.—The Same _ III; _ The invagination completed _ the sutures temporarily used as traction sutures being now tied, in pairs, as anchorage sutures, **a**. The upper margin of the intussuscipiens (the distal aspect of the ureter) is sutured to the lateral wall of the intussusceptum by a few interrupted stitches, **b**, which do not penetrate the wall of the intussusceptum.



Figs. 4566 and 4567.—URETERO-URETEROSTOMY BY INVAGINATION, WITH SPLITTING _ Poggi: _ **a**, The intussuscipiens is stretched and split. A catgut tractor is carried through the posterior wall of the intussusceptum, **b**, near its lower limit _ then down through the intussuscipiens and through its wall, from within outward _ drawing the upper segment with it, after which it is tied. The slit is closed and the lateral aspect of the two segments are united by interrupted sutures, **c**.

10. **Uretero-ureterostomy by End-into-end Invagination, Without Support, With Splitting** _ Kelly (Figs. 4568, 4569).—This may be regarded

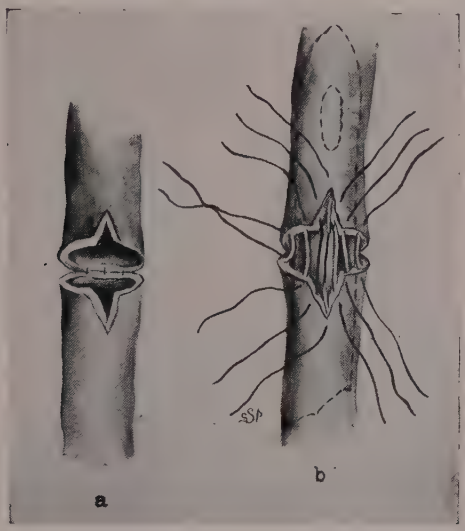
as a modification of the preceding technic in two directions: – the temporary use of a simpler form of traction suture, and the inclusion of the slit portion of the intussuscipiens in the circular suturing. A single needle, upon a single piece of silk, passes from without inward, through the wall of the distal ureter – up its lumen – through both walls of the proximal ureter – back down the lumen of the distal ureter – and out through or near the site of original entry. The proximal is then drawn down into the distal split ureter. In the suturing of the margins of the distal to the outer coats of the proximal ureter the split portion of the distal ureter is taken up in increasing the circumference of its free end.



Figs. 4568 and 4569.—End-to-end Ureteral Anastomosis by Invagination, with Splitting – Kelly, – I: a, Through-and-through temporary traction suture is shown drawing the intussusceptum, b, down into the marginally split intussuscipiens, c, and emerging through the wall of the latter. II: The margin of the split intussuscipiens is sutured to the lateral aspect of the intussusceptum. The traction suture is then withdrawn.

11. Terminoterminal Uretero-ureterostomy, Aided by a Support and by Slitting – Albarran (Figs. 4570, 4571).—The divided ends of the ureter are brought into contact, and three non-penetrating Lembert sutures are placed from without, so as to hinge together the posterior aspect of the union (Fig. 4570, a). A ureteral sound is then passed from the meatus through the ureter to the renal pelvis – and this is held in position as a support during suturing. An axial incision of limited length through the middle of each lip of the ends of the ureter, directly opposite the three posterior sutures. Axially placed interrupted, non-penetrating sutures are then placed between the opposite margins, in the manner shown in Fig. 4571, b. These sutures are then tied, simultaneously uniting and increasing the diameter of the ureter at the site of suturing. The ureteral bougie or catheter is withdrawn.

12. **Uretero-ureterostomy by Proximal Ligation and End-into-side, or Terminolateral, Implantation** _ Van Hook.—Ligate the distal part of the ureter circularly, about 3 to 6 mm. ($\frac{1}{8}$–$\frac{1}{4}$ inch) from its free end with silk or gut (Fig. 4572). Commencing about 6 mm. ($\frac{1}{4}$ inch) below this ligature, make a longitudinal incision through all the coats of the distal ureter for a distance



Figs. 4570 and 4571.—Terminoterminal Uretero-ureterostomy, Aided by Support and by Splitting _ Albarran: _ **a,** The posterior aspect of the transversely divided ureter is united by three interrupted sutures _ following which an incision is made down the center of the lips of the anterior aspect; _ **b,** a bougie is introduced into the ureter temporarily _ upon which the wound is sutured by axially placed, non-penetrating sutures _ in such a way as to rather increase than diminish the ureteral caliber.

equal to the diameter of the ureter _ with fine, narrow knife, or sharp-pointed scissors. Make a longitudinal incision in the proximal ureter from the margin of the free end upward for about 6 mm. ($\frac{1}{4}$ inch). (This slit is opposite to the surface shown in the picture.) A traction suture of fine catgut upon two needles is passed just as in the invagination method _ about 3 mm. ($\frac{1}{8}$ inch)

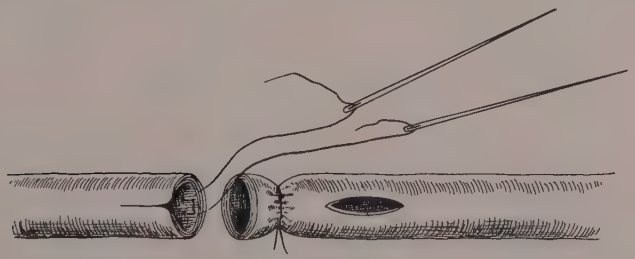


Fig. 4572.—Uretero-ureterostomy by Van Hook's Method; _ I, First step. (Modified from Van Hook.)

from the free end, and from nearly 2 to 3 mm. ($\frac{1}{16}$–$\frac{1}{18}$ inch) apart, and upon the lateral aspect opposite to the vertical slit (Fig. 4573). Pass the points of both needles through the slit into the distal ureter, and thence for about 1.3 cm. ($\frac{1}{2}$ inch) below its lower end _ thence penetrate the wall of the distal ureter outward, upon the same aspect of the ureter as the slit, and both needles

held at the same horizontal level (side by side _ not one over the other). Unthreading the needles, draw (invaginate) the proximal into the distal ureter, until the slit in the proximal is well within the slit in the distal _ and then tie the sutures. Complete the union by suturing the edges of the vertical incision around the proximal, the sutures passing through the fibrous and muscular coats (Fig. 4574). Further protect the site by peritoneum folded around it, if the operation be intraperitoneal. *Note:* Where the proximal end (from distention or other cause) is too large to go into the distal, it may be narrowed by placing and tying two or more sutures in its free end. Both ends of these

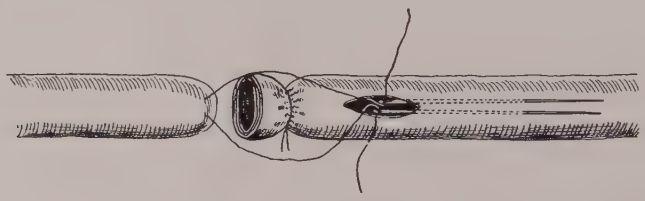


Fig. 4573.—Uretero-ureterostomy by Van Hook's Method; _ II, Second step. (Modified from Van Hook.)

"narrowing sutures" are then threaded _ and all six needles passed into the slit, in pairs, and the threads tied.

The carrying out of the technic *in situ* is shown in Fig. 4575 _ and is much simplified by the use of the Reverdin needle.

13. **Uretero-ureterostomy by Distal Ligation and End-into-side, or Terminolateral, Implantation** _ Emmet's modification of Van Hook's method (Figs. 4576, 4577).—The very slight difference that exists between this and Van Hook's method consists in the employment, in Emmet's modification, of three traction sutures, which finally become anchorage sutures (Fig. 4576, **a**), _ and the use of a continuous suture to reinforce the site of entrance of the end of the proximal into the side of the distal ureter (Fig. 4577, **h**).

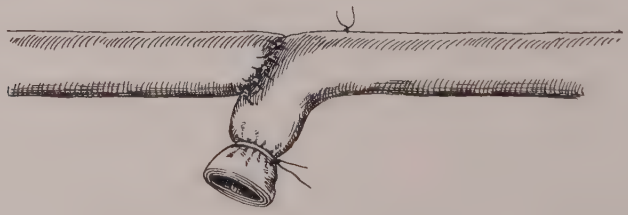


Fig. 4574.—Uretero-ureterostomy by Van Hook's Method; _ III, Third step. (Modified from Van Hook.)

14. **Uretero-ureterostomy by Distal Ligation, Followed by End-to-side, or Terminolateral, Anastomosis** (Fig. 4578).—The divided end of the distal portion of the ureter is ligated with silk. Just below the site of ligation in the distal ureter an axial incision is made, long enough to correspond with the obliquely divided end of the proximal portion of the ureter. The free end of the proximal ureter is cut obliquely, so as to come into easy relation with the incision through the wall of the distal ureter. The two openings are then held in contact with each other while being sutured into permanent anastomosis. If the suture is to penetrate all the coats, fine chromic catgut

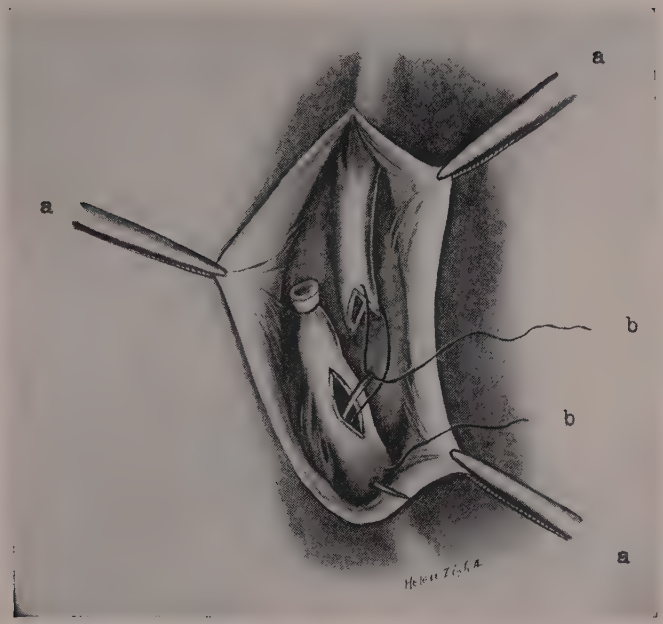
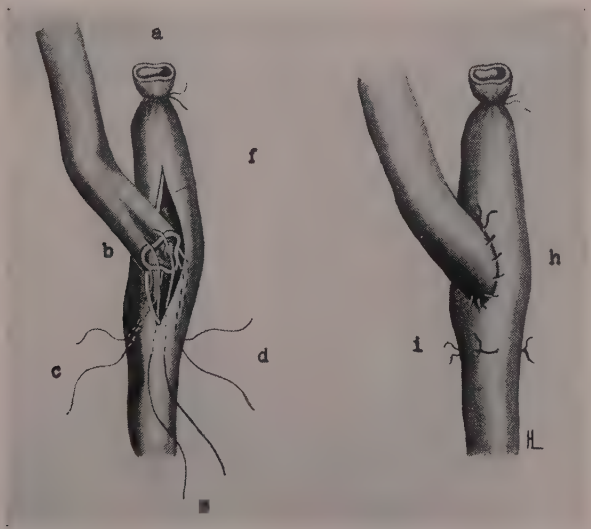


Fig. 4575.—Terminolateral Uretero-ureterostomy _ Van Hook's Method: _ a, a, a, Forceps retracting the margins of the incised parietal peritoneum, overlying the ureter. The distal end of the proximal ureter is being drawn by threaded traction sutures, b, b, through the incised window in the ligated proximal end of the distal portion. The details of the ureteral union are shown in Figs. 4572–4574. The incised peritoneum is finally sutured.



Figs. 4576 and 4577.—End-into-side Ureteral Anastomosis _ Emmet; _ Following division of the ureter, the proximal end, a, of the distal portion of the ureter is closed by circular ligature. The distal end, b, of the proximal part of the ureter, is pierced by three sutures, calculated to diminish its caliber by puckering, under axial traction. The three pairs of free ends, c, d, e, each threaded upon a separate needle (or, better, conducted by a Reverdin needle) are carried through the window, f, in the distal ureter, and out through the ureteral wall, all three on the same horizontal level, proportioning the circumference into thirds; h, the intussuscipiens sutured around the intussusceptum; _ i, the three traction sutures tied as permanent sutures.

should be used. If the mechanical details of a non-penetrating suture can be carried out, as is always preferable, fine silk should be employed.

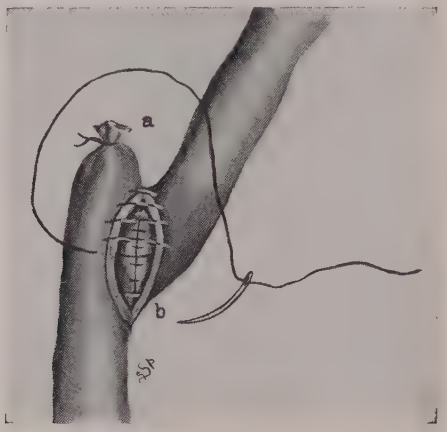


Fig. 4578.—End-to-side Uretero-ureterostomy: _a, The proximal end of the distal ureter is ligated and an incision made into its lateral aspect, to accommodate the end of the proximal ureter. The distal end of the proximal ureter is then sutured into the lateral opening of the distal ureter.

15. **Uretero-ureterostomy by Both Proximal and Distal Ligation, Followed by Side-to-side, or Laterolateral, Anastomosis** _ Monari (Fig. 4579).—In this procedure the steps are identically the same as that in the method last described (q. v.) _ except that both proximal and distal ends of the ureter are ligated.

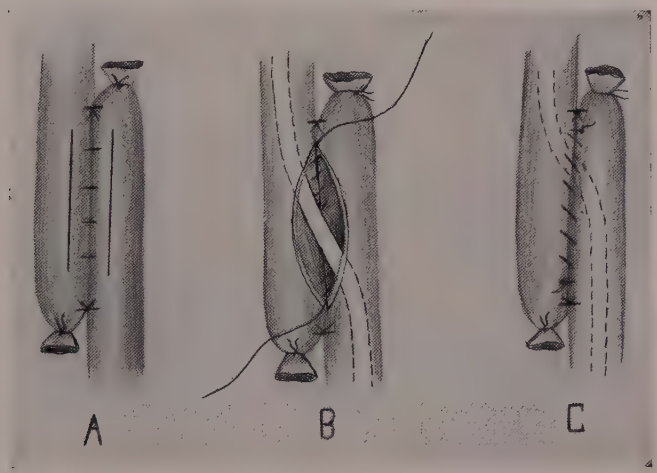


Fig. 4579.—Laterolateral Uretero-ureterostomy _ Monari; _ Each end of the divided ureter is closed by ligature. The sides of the ends are brought together _ after which a lateral incision is made in each _ and the margins of the two openings are sutured together by, preferably, non-penetrating sutures.

16. **Uretero-ureterostomy by Both Proximal and Distal Ligation, Followed by Side-to-side or Laterolateral Anastomosis Upon a Support** _

D'Urso and Fabri's Modification of Monari's Method (Figs. 4580–5842).—In this technic, both proximal and distal ends of the divided ureter are ligated _ after which the more distant or posterior line of suturing, uniting the two parts of the ureter, is placed, as in intestinal suturing (Fig. 4580, A). Two opposite axial incisions are made, near the first line of suturing, and near the sites of ligation. Part of a ureteral bougie is then temporarily passed into the lumina of the two portions of ureter (Fig. 4581, B) to serve as a support during suturing _ after which the nearer line of suturing is placed _ but before it is tightened the bougie is withdrawn. Fine chromic catgut should be employed, if the sutures penetrate all the coats.

Crossed Uretero-ureterostomy.—It may sometimes happen that so much of the ureter is involved, traumatically or pathologically, that no chance will remain, after correction of the defect, for anastomosing the proximal and distal portions of the ureter upon the side of involvement. Under such



Figs. 4580–4582.—Uretero-ureterostomy _ D'Urso and Fabri's Modification of Monari's Side-to-side Anastomosis: _ A, Closure of the ends and suturing of the ends side to side, with line for incision into each ureter; _ B, each ureter incised and the catheter passed into the lumina; _ C, the openings into the ureter closed _ the site of the temporary catheter being shown. The bougies are disproportionately small. (Redrawn from Duval.)

circumstances the only alternatives against removing the kidney of that side, or bringing the proximal end of the ureter out upon the skin, is either to anastomose the proximal end of the involved ureter into the bladder, vagina, or bowel, or to make a terminolateral implantation of the proximal end of the involved ureter, into the side of the opposite ureter, beneath the posterior parietal peritoneum, which is opened for the purpose, and closed afterward. The technic is shown in Fig. 4553. The distal end of the involved ureter is ligated.

Comment.—In the operations of invagination, which are the ones generally employed, instead of introducing the traction sutures through all the coats of the proximal end, it would be better to introduce a single needle on a thread, from without through the fibrous and muscular coats alone _ then, keeping the needle on the original end, thread another needle on the other end, and proceed as is ordinarily done. Thus no capillary thread passes into the lumen of the proximal portion _ and the approximated outer wall of the

proximal portion to the inner wall of the distal portion blocks off the wall of the distal ureter.

In some cases the kidney has been lowered somewhat from its original site in order to furnish additional length for uretero-ureteral anastomosis.

Comparison of Methods of Uretero-ureterostomy.—Van Hook's terminolateral implantation method is probably the best for all-round use – or one of the Poggi methods.

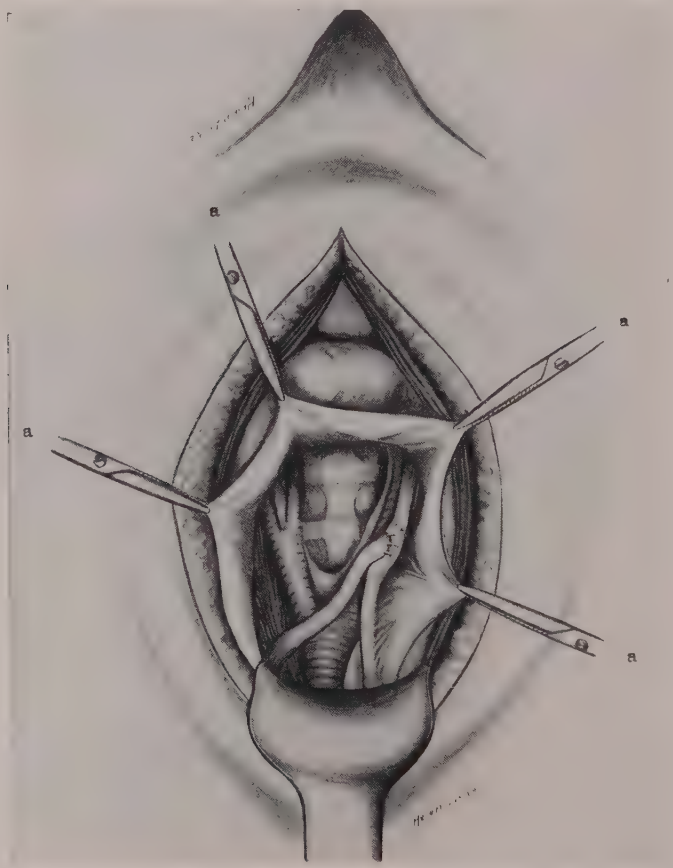


Fig. 4583.—End-in-side Crossed Uretero-ureterostomy – Bernasconi and Colombino: – a, a, a, tractors of the temporarily raised posterior parietal peritoneum – the patient in Trendelenburg's position. The proximal end of the severed left ureter is mobilized sufficiently to be brought across the median line and anastomosed, through a lateral incision, with the otherwise intact right ureter – it being impossible to restore the urinary tract upon the left side.

End-to-end anastomosis is more apt to be followed by leakage. End-into-end anastomosis is less apt to be followed by leakage and stricture. In end-into-end anastomosis about 2.5 cm. (1 inch) of ureter is taken up. In end-in-side implantation about 4 cm. ($1\frac{1}{2}$ inches) of the ureter is consumed.

Temporary drainage is always safer.

IMPLANTATION OF THE URETERS INTO THE HOLLOW VISCERA, IN GENERAL

After division of the ureter, or after excision of a part of the ureter (by accident, or other cause), the lower end of the proximal portion of the ureter may be implanted, or "grafted," into the bladder, large intestine (cecum, sigmoid, or rectum), vagina, opposite ureter, pelvis of opposite kidney, upper portion of the distal end of the same side (which is, really, uretero-ureterostomy), or into the skin.

When a simple division has taken place, without loss of substance, a simple implantation, or anastomosis of the proximal into the distal end (uretero-ureterostomy) is best.

Where a loss of some extent of ureter has occurred a uretero-ureterostomy is still the best course, where it is possible to approximate the ends without too great tension. Where the loss is too great for this an implantation into some other structure becomes necessary.

The most usual sites (in order of preference) into which the proximal end of the ureter is implanted are _ bladder, large intestine (rectum), and skin.

The distal end is ligated and left *in situ*, some Surgeons first cauterizing the stump.

As many of the ureteral implantations are performed for accidents to the ureter occurring during other operations, the parts are usually already exposed _ requiring none, or but little more dissection to fully expose them.

IMPLANTATION OF THE URETER INTO THE BLADDER (URETEROCYSTOSTOMY)

Description.—Implantation of ureter into male or female bladder. In Ureterocystostomy the implantation itself may be intraperitoneal or extraperitoneal. Where possible, the extraperitoneal implantation is preferable to the intraperitoneal implantation _ although when the latter is done, the operation site should be so walled off by peritoneum as to practically amount to an extraperitoneal implantation. As to the manner of exposing the ureter, this is done generally by an intraperitoneal operation. It is sometimes done through an extraperitoneal route, as, for example, in performing a suprapubic cystotomy, followed by exposure of the ureter by cutting through the base of the bladder. It may also be exposed extraperitoneally through the vagina. In the following description it will be supposed that the ureter is severed near its vesical end, the proximal end being within reach of the bladder.

Preparation _ Position _ Landmarks _ Incision.—As for median abdominal section below the umbilicus.

Operation.—Having performed a lower median abdominal section, with the patient in the Trendelenburg position, displace the intestines toward the diaphragm and to the opposite side _ isolating the ureter and tracing it to the bladder. Incise the posterior peritoneum over the site of the intended division of the ureter. Having freed the peritoneum and connective tissue from the ureter by blunt dissection divide the ureter transversely. Ligate the distal end of the ureter and return it to its site. Make an incision through all the walls of the bladder, as nearly the normal site as possible and in the long axis of the bladder, and just large enough to admit the ureter (Fig. 4584). The ureter is then grasped with long, thin forceps and carried within the bladder sufficiently far for its free end to project slightly within the bladder cavity (or the technic to be described below may be adopted). With a fine, curved needle, and with silk or gut, the edges of the bladder wound are sutured around the ureter, passing through all the coats of both bladder and ureter _ except the mucous membrane.

The peritoneum is then sutured around the site of junction, so as to practically render it extraperitoneal. Where the technic has been satisfactory the abdomen may be entirely closed at once – which is always preferable. Otherwise drainage is temporarily established.

Comment.—Where much ureter has been lost the bladder is sometimes drawn up into the pelvis and sutured to the broad ligament, in the female, or other structure, before implanting.

In the female special forceps may be introduced through the vagina, and thence through the incision made into the bladder to receive the ureter – seizing the ureter and drawing it through. In such cases the bladder is cut through from the outside upon a sound introduced through the urethra.

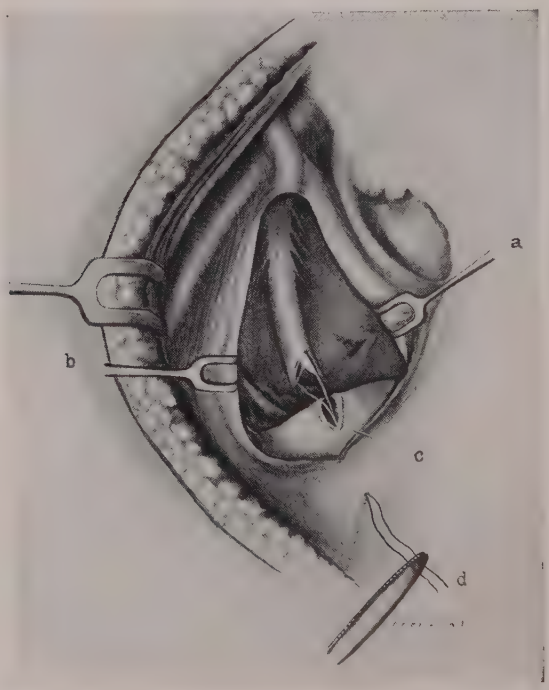


Fig. 4584.—Subperitoneal Ureterocystostomy Following Transperitoneal Exposure; – The adjacent parts of the ureter and bladder are exposed through the incised and retracted posterior parietal peritoneum, **a** and **b**. The distal end of the involved ureter is split and pierced by a tractor suture. A nearby incision having been made into the bladder, **c**, the free ends of the tractor are carried, upon a ligature carrier following a needle, into the bladder, through the incision – the needle and carrier emerging through the bladder wall near the incision, **d**. The ureter is then anchored into the bladder wound, which is sutured up around it – after which the traction suture is withdrawn.

In order to counteract the upward pull upon the implanted end of the ureter, gut traction sutures are sometimes placed in the end of the proximal portion, in the case of the female, and carried out the urethra and tied to the dressing.

To imitate nature the ureter has been sutured into the bladder through an oblique opening. And to give a valve effect the tip of the free end in the bladder has been split.

Instead of carrying the end of the ureter into the bladder with delicate forceps and holding it there while it is being sutured, a traction suture may be threaded through the free proximal end of the divided and split ureter by



Fig. 4585.—The Same _ II; _ The immediate site of anastomosis is shown, with the bladder incision sutured around the entering ureter by fine catgut sutures which do not penetrate the mucosa of either structure. And the portion of the ureter immediately adjacent to and just outside of the bladder opening is anchored to the bladder wall by relaxation sutures, to take the strain off the site of anastomosis.

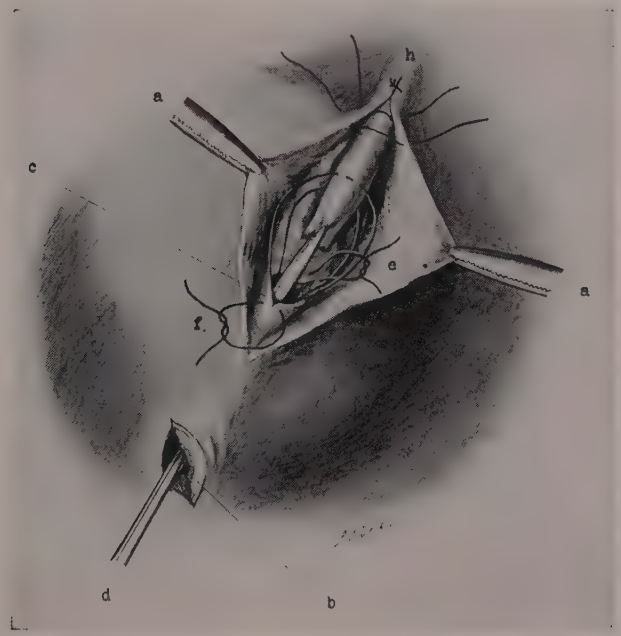


Fig. 4586.—Extraperitoneal Implantation of the Divided Ureter Within the Bladder Following Transperitoneal Exposure of the Parts; _ The posterior parietal peritoneum is incised over the involved ureter and over the bladder in its vicinity, and retracted, **a, a.** An incision is then made into the bladder in the most accessible site, **c** _ and a second opening, **b,** a short distance from it. A pair of slender forceps, **d,** is carried into the bladder through the latter opening and out through the former. Two non-penetrating, anchoring sutures, **e, f,** having been carried through the opposite walls of the ureter and the margins of the wound of entrance into the bladder, the tip of the ureter is seized by the forceps and drawn within the bladder, after which the anchoring stitches are tied, closing the bladder about the ureter. Both bladder wounds are then sutured (the wound of entry, up to the ureter) _ and the peritoneum, **h,** is sutured over them.

Reverdin or other needle, carried into the bladder, and then out again (v. Fig. 4584, **d**) _ and by this traction suture the end of the ureter is drawn into

the bladder and held there while the margins of the bladder incision are being sutured to the wall of the implanted ureter. The completion of the anchorage, in this case, is shown in Fig. 4585, where not only are the lips of the bladder incision seen to be sutured around the end of the ureter, but the portion of the ureter immediately adjacent to the part buried in, and gripped by, the bladder incision, is sutured by non-penetrating relaxation stitches to the wall of the bladder, to relieve the strain upon the very end of the ureter. The peritoneum is finally sutured over the site of ureterocystostomy.

The anastomosis between the proximal end of the ureter and the interior of the bladder may, after the ureter has been exposed by incising the parietal peritoneum and retracting its edges (Fig. 4586, **a a**), be accomplished by making two openings into the bladder. One opening is made conveniently near to the end of the ureter, at **c**, in the above illustration – and a second opening, at **b**, a short distance from the first. Two fine chromic catgut sutures are carried through the outer coats of the ureter, near its free end, **e**, into its posterior wall, and **f**, into its anterior wall. These traction sutures are carried by a curved needle, into the bladder, and out through its wall again – one emerging near the anterior end of the bladder incision, and the other near the posterior end. Through the bladder incision, **b**, a pair of slender forceps, slightly curved, are carried – and out through the opening, **c** – where the blades are separated and the free end of the ureter grasped and drawn back into the bladder. While the ureter is held under gentle tension by the forceps, the former traction sutures are converted into permanent anchorage sutures by being tied. The bladder incision, **c**, is then sutured around the entering ureter, by non-penetrating, fine chromic catgut stitches – and the parietal peritoneum closed over it. The bladder incision, **b**, is closed by buried, non-penetrating sutures – and the peritoneal wound is stitched over it.

If the end of the ureter which is to be implanted be split axially for a short distance (about 8 mm., or $\frac{1}{3}$ inch), subsequent stenosis at the site of anastomosis is less apt to occur.

OTHER METHODS OF URETEROCYSTOSTOMY

Ureterocystostomy by the Aid of a Ureteral Bougie Passed Upward from the Urethra.—While this method is more easily carried out in the female, it is also feasible in the male. The divided proximal end of the ureter is split – a limited incision is made obliquely through the bladder wall, conveniently placed, as to the ureter – the bougie is carried through the urethra, into the bladder, out through the incised wound in the bladder (not out through the natural ureteral orifice), and into the lumen of the proximal portion of divided ureter – after which the ureter is worked down over the sound, into the bladder, and held there during the placing of the anchoring stitches, which are inserted in the same manner as heretofore described. Finally, the parietal peritoneum is closed over the anastomosis, and the sound is withdrawn.

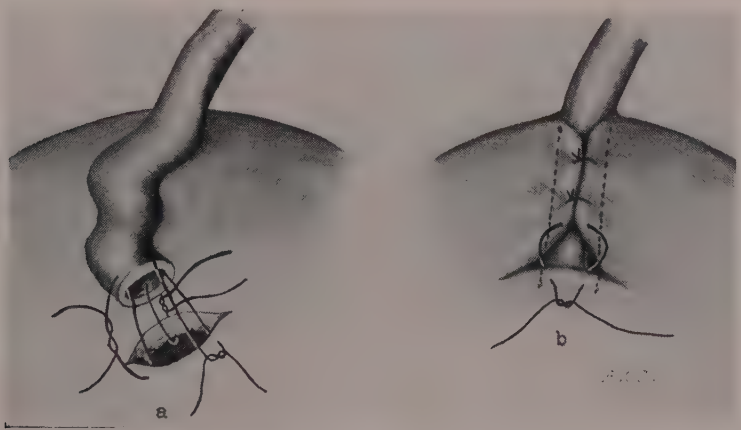
Ureterocystostomy by Invagination of the Ureter into the Bladder, Followed by Burial of the Adjacent Ureter in the Bladder Wall.—This may be accomplished in one of several ways. By one method, the proximal end of the divided ureter is carried into an incision in the wall of the bladder, and is anchored there by two tiers of interrupted, non-penetrating sutures, on each side, placed opposite each other – the lower tier anchoring the end of the ureter flush with the mucosa of the bladder, and the outer tier anchoring the wall of the ureter flush with the surface of the bladder (Fig. 4587, **a**). When the anchorage is accomplished, the adjacent bladder wall is brought over the ureter with several interrupted sutures, as shown in Fig. 4588, **b**.

In another method, three interrupted sutures, of fine chromic catgut, penetrating all the coats of both ureter-end and bladder incision, anchor the



Figs. 4587 and 4588.—URETEROCYSTOSTOMY BY INVAGINATING AND BURYING: – a, The distal end of the ureter is carried through the incised bladder wall, until flush with its mucosa. Interrupted, non-penetrating, buried sutures anchor the lower part of the tube to the inner wall of the bladder. These are followed by non-penetrating sutures of the upper part of the ureter and outer wall of the bladder; – b, the junction of the ureter and bladder is buried, and further protected by suturing the outer bladder wall over the ureter.

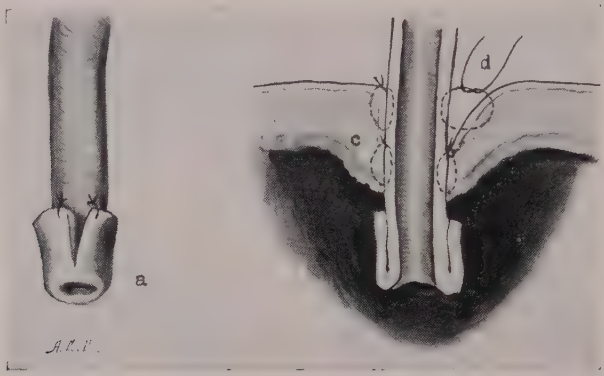
ureter in the bladder opening (Fig. 4589, **a**) – after which the nearby wall of the bladder is brought over the adjacent ureter by a few interrupted sutures (Fig. 4590, **b**).



Figs. 4589 and 4590.—INTRAPERITONEAL URETERO-CYSTO-NEOSTOMY BY INVAGINATION AND BURYING: – a, Three penetrating sutures, through the free margins of ureter and bladder incision, draw the distal end of the ureter through the incised bladder wound, and anchor it there – and these may be reinforced by marginal sutures. The adjacent bladder wall is then sutured over the ureter, in such a manner as to bury it and, at the same time, reinforce the junction.

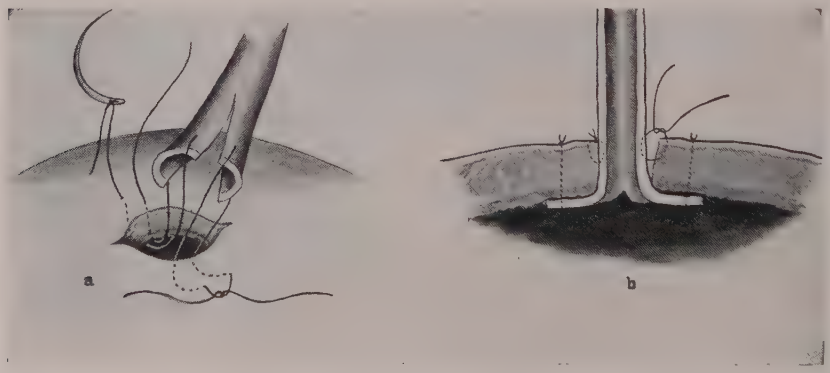
Intraperitoneal Ureterocystostomy, or Uretero-cysto-neostomy, by Invagination of Ureter Into Bladder Incision – Ricard.—The proximal end of the ureter is limitedly slit, turned back, and its corners tacked to itself by two catgut stitches (Fig. 4591, **a**). The cuffed end of the ureter is carried

through the incised bladder, well into its cavity – after which it is anchored by lower and upper tiers of non-penetrating sutures, which tend to bury the ureter funnel-like by the inversion of the adjacent bladder wall about the end of the ureter (Fig. 4592, **c, d**).



Figs. 4591 and 4592.—Intraperitoneal Ureterocystostomy, or Uretero-cysto-neostomy – Ricard's Method: – **a,** The ureter is incised, and turned back to form a cuff, the corners of which are anchored by sutures. The cuff end of the ureter is invaginated some distance into the bladder, and fixed there by buried, **c,** and superficial, **d,** non-penetrating sutures.

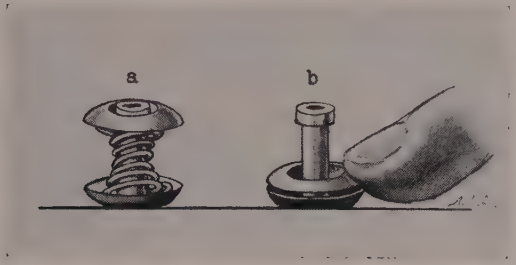
Ureterocystostomy by Invagination of Split End of Ureter into Bladder Incision – Payne.—The proximal end of the ureter is split into two lateral flaps. Through all the coats of each of these flaps, and all the coats of the lips of the bladder incision, a chromic catgut suture is passed in the manner



Figs. 4593 and 4594.—Ureterocystostomy – Payne: – **a,** The distal end of the ureter is split, and a tractor suture placed through each split half. A curved needle is threaded upon each free end. An incision having been made into the bladder, the needle and tractors are carried through the bladder incision, from without inward – and out through the bladder wall, from within outward, upon opposite sides of the wound. **b,** The traction sutures are now tied as anchorage sutures – and the wall of the bladder sutured to the wall of the ureter by interrupted, non-penetrating sutures. Any excess of the bladder wound is closed by suture.

shown in Fig. 4593, **a** – first serving as traction sutures, and finally as anchorage sutures. These stitches are readily placed with a curved Reverdin needle – and when drawn into place and tied, present the appearance shown in Fig. 4594, **b.** The margins of the bladder incision are then sutured to the wall of the ureter by sutures which do not penetrate the mucosa of either structure.

Ureterocystostomy by Means of the Boari Button.—The Boari button is shown with its cups thrown apart, by the unrestrained spring, in Fig. 4595, a _ and with its cups or flanges together, by compression of the spring, in Fig. 4596, b. The button is only in action when the spring is released and the flanges apart _ whereas the Murphy button, used in intestinal work, is only in action when its spring is compressed and the flanges in contact.



Figs. 4595 and 4596.—The Boari Ureteral Anastomosis Button: _ a, Button with its flanges separated by the spring; _ b, the flanges approximated by thumb compression, while the metallic pin is being passed through the shaft to maintain compression.

During the act of insertion a small metallic rod passes through a hole in the shaft, thus holding the flanges together _ until its removal releases them.

The proximal end of the ureter is dilated, slipped over the smaller end of the button, and tied with catgut or silk (Fig. 4597, a) _ the flanges being held in contact during this part of the technic by the rod. The larger end of the



Figs. 4597 and 4598.—Ureterocystostomy by the Boari Button: _ a, The distal end of the ureter has been tied around the smaller end of the button (whose ends are here shown held apart by the needle). A purse-string suture is passed around the margin of the bladder incision _ which will invert this margin, serosa to serosa (or cellulosa to cellulosa) when gathered around the ureter. b, The closure is further reinforced by Lembert stitches of ureteral serosa (or cellulosa) to bladder serosa. The pressure-flange of the button is seen in operation.

button, represented by the compressed flanges is then carried through the limited incision made through the wall of the bladder _ after which a non-penetrating purse-string suture is insered around the incision into the bladder, which, when tied, will tend to invert the wall of the bladder somewhat. The The metallic pin is now withdrawn from the hole in the shaft, releasing the movable flange, which then springs outward, thereby compressing the serosa

of the bladder (or fibrosa, if freed of peritoneum) into contact with the fibrosa of the ureter (Fig. 4598, **b**) – between which two structures union will occur. The site of anastomosis is generally reinforced by several sutures of the Lembert type. The button usually drops into the bladder, by a process of sloughing, in from ten to twelve days – whence, in the case of a female, it is removed by dilating the urethra and inserting forceps, by which it is withdrawn – and, in the case of the male, through a cystotomy wound.

METHODS OF IMPLANTING A SINGLE URETER INTO THE BOWEL (URETERO-ENTEROSTOMY—URETERO-INTESTINAL ANASTOMOSIS)

Description.—In this procedure, the ureter is implanted, or anastomosed, by simple suturing, or by mechanical device, into the antimesenteric aspect of some part of the large intestine – generally either into the rectum, sigmoid flexure, or cecum, as well as the ascending and descending colons (constituting ureterorectostomy, ureterocolostomy, or ureterocecostomy) – ureterocolostomy, or ureterorectostomy being the forms of uretero-intestinal anastomosis most frequently performed.

The mechanical difficulties of implantation are not so great – the chief source of failure in the technic, and of death, being infection of the ureters, and then of the kidneys, from the intestinal tract.

Owing to the high mortality connected with uretero-enterostomy the operation has become a last resort in surgery of the urinary system. It is doubtful whether there is any justification for unilateral uretero-enterostomy. If crossed anastomosis of the involved ureter with the sound ureter (trans-uretero-ureteral anastomosis) cannot be brought about (simple ureterocystostomy being impossible), it even becomes a question as to whether it may not be more conservative to sacrifice the kidney of the involved side, by excision, rather than risk losing it, and life, from subsequent infection. The transplantation, however, which is most warrantable, is the implantation of both ureters, along with their vesical endings, into the bowel – and the chief indications for the procedure are in excision of the bladder and in otherwise inoperable cases of exstrophy of the bladder.

In those cases where, in spite of its drawbacks, unilateral uretero-enterostomy is performed, its only indication arises in those cases where, for some reason, ureterocystostomy is impossible.

The operation is usually performed transperitoneally, and by the abdominal route. Extraperitoneal implantation is sometimes performed in the case of the colon and rectum. The particular part of the large intestine (v. s.) into which the proximal end of the involved ureter will be implanted, will depend upon the site at which the ureter must be divided, and upon the circumstances of the case. The ligation of the distal end of the divided ureter – and the freeing of the proximal end, sufficiently for the manipulations of implantation – are features common to whatever type of uretero-intestinal anastomosis may be adopted.

Valvular Ureterocolostomy.—The abdomen is opened, the ascending or descending colon exposed, and the proximal end of the divided ureter sufficiently mobilized to be brought into contact with the site of anastomosis (Fig. 4599, **c**). In freeing the ureter, the peritoneum is incised over it, and sutured over the bed afterward. The parietal peritoneum is also incised over the new path of the ureter, and is subsequently sutured over it. At some little distance from its free end the ureter is anchored to the lateral aspect of the colon by two fine chromic catgut sutures, which only penetrate the outer coats of both ureter and colon. This anchorage is made about 1.5 cm. ($\frac{5}{8}$ inch) from the free end of the ureter – and in the final steps of the operation not only is the

peritoneum sutured over the ureter in its new bed, but the walls of the colon are sutured over the part of the otherwise bared ureter where it crosses the colon. A quadrilateral flap is now raised upon the anterior aspect of the colon. This outer flap consists of serosa and muscularis only _ is 2 cm. ($\frac{3}{4}$ inch) in axial length, and 1 cm. ($\frac{3}{8}$ inch) transversely _ and hinging above (v. Fig. 4599, **a**). This flap is dissected from the mucosa and turned upward. A corresponding flap of mucosa is then raised, similarly turned upward upon itself, and its lower free edge sutured to its base (v. Fig. 4599, **b**). A mucous valve is thus formed _ and upon its outer aspect the end of the ureter is placed, and anchored by one or two fine chromic catgut sutures (Fig. 4600). Finally, the outer flap of serosa and muscularis is dropped down over the folded mucous

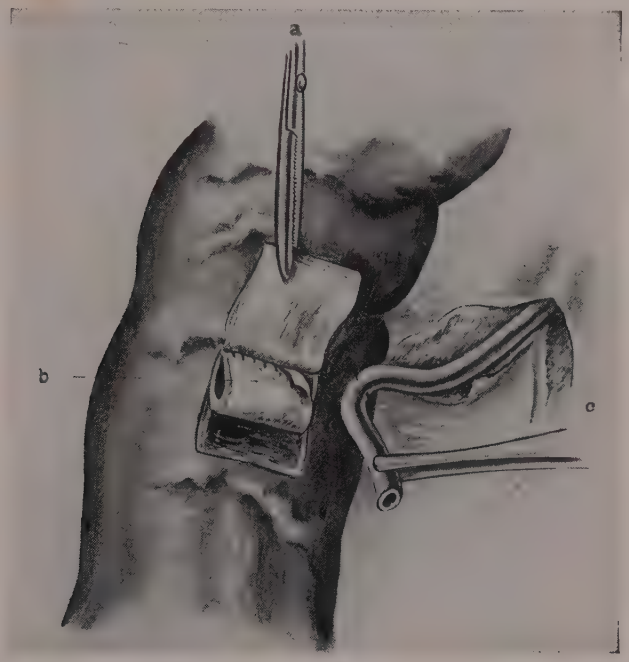


Fig. 4599.—Valvular Ureterocolostomy _ I; _ A square flap, **a**, hinging above, of the outer rectal coats, is raised from the anterior rectal wall. The mucous coat is then similarly cut. The mucous flap, **b**, is turned outward, and its free edge sutured to the base of the main flap. The ureter is then freed from its old bed, **c**, and brought toward the rectal flap _ and is anchored to the rectal wall, nearby, by one or two non-penetrating sutures. A new peritoneal bed is made for the transposed ureter, as shown in the illustration.

flap and anchored ureter-end, trap-door fashion, and its margins sutured _ the completed operation appearing as shown in Fig. 4601.

Uretero-intestinal Anastomosis _ Chaput's Method.—The divided, proximal end of the ureter is brought into contact with the postero-internal wall of the colon, where it is anchored to the yet unopened colon by two or three non-penetrating stitches placed posteriorly _ Fig. 4602 _ (these stitches passing only through the fibromuscular coat of the ureter, on the one hand, the seromuscular coats of the colon, on the other _ the only part of them shown in the illustration being where they cross from one structure to the other). An oblique incision is now made through the wall of the colon about 1 cm. ($\frac{3}{8}$ inch) in length, and a few millimeters (possibly $\frac{3}{16}$ inch) below the site of

anchorage. The posterior mucomucous sutures of fine catgut are next applied the long sutures – then the anterior mucomucous sutures – and, finally,

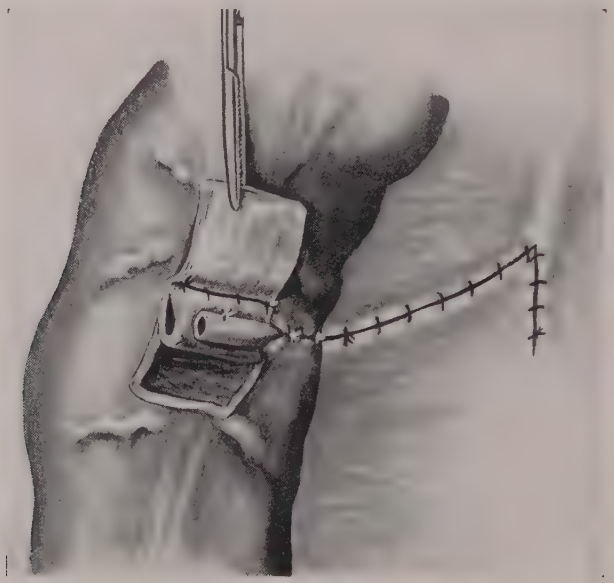


Fig. 4600.—The Same – II; – The distal end of the ureter is sutured to the mucous flap – and the adjacent wall of the rectum is folded and sutured over the outlying ureter. The old peritoneal bed is closed – and the raised peritoneal flaps are sutured over the ureter in the new bed.

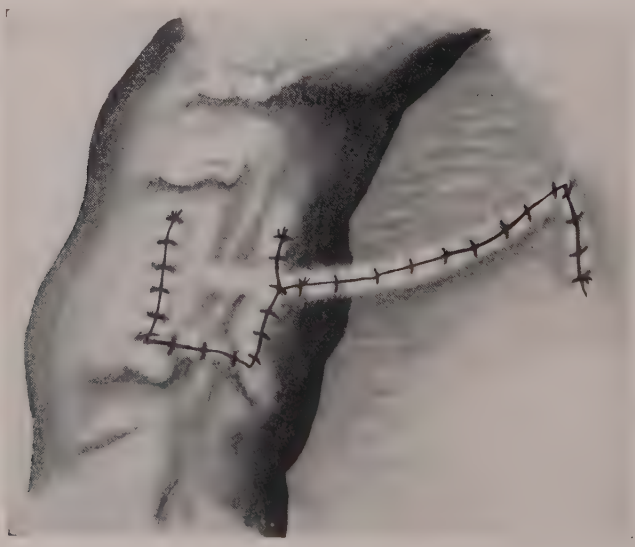


Fig. 4601.—The Same – III; – The rectal flap of outer coats is turned down over the half-length mucous flap – burying the ureter between them – and is sutured to the margins of the rectal wound.

the anterior musculomuscular sutures. Last of all, the incision into the colon is sutured together, and about the implanted ureter, in such a way as to approxi-

mate the lips of the colonic incision at a right angle to the direction of the original incision (Fig. 4603). This technic is difficult to carry out unless the ureter has been dilated by previous distention.



Fig. 4602.—Ureterocolostomy or Ureterorectostomy – Chaput's Method – I; – An oblique incision is made into the lateral wall of the rectum, at first through only the outer coats. The outer coats of the ureter are then sutured to the outer coats of the rectum (here represented by the middle tied suture). The rectal mucosa is then incised and the mucosa of the ureter is sutured to the mucosa of the rectum (here represented by the two long, loose sutures). These steps are repeated upon the anterior lips of the ureteral and rectal wounds.

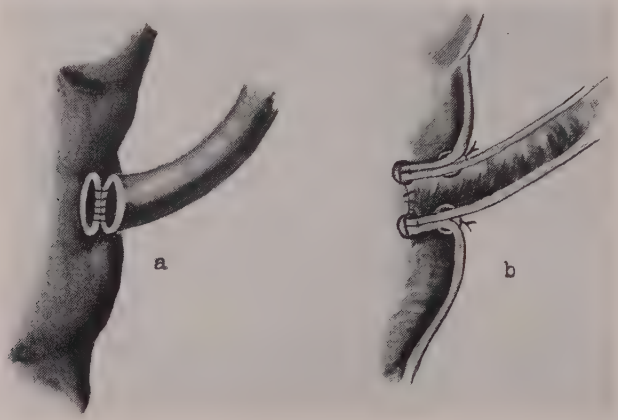
Uretero-intestinal Anastomosis by Invagination.—The proximal end of the ureter is brought into contact with a corresponding incision through



Fig. 4603.—The Same – II; – The rectal wall is then sutured about the ureter in such a way as to bury the ureter obliquely in the rectal wall – the line of suturing being at a right angle to the line of incision.

the wall of the bowel, where it is first sutured either by a tier of marginal stitches of fine chromic catgut, passing through all the coats of both structures

_ or by a first tier of non-penetrating silk sutures (Fig. 4604, **a**). This site of anchorage is then protruded on into the bowel _ the protruding ureter tending



Figs. 4604 and 4605.—URETERO-URETEROSTOMY BY INVAGINATION: _ **a**, Suture of the distal end of the ureter to margins of the rectal incision by through-and-through sutures of all the coats; _ **b**, the site of anastomosis is inverted into the rectum by an outlying tier of interrupted sutures.

to limitedly invert the wall of the bowel about itself _ and, at the level of this inversion, a second tier of penetrating catgut sutures or non-penetrating silk sutures is placed (Fig. 4605, **b**).

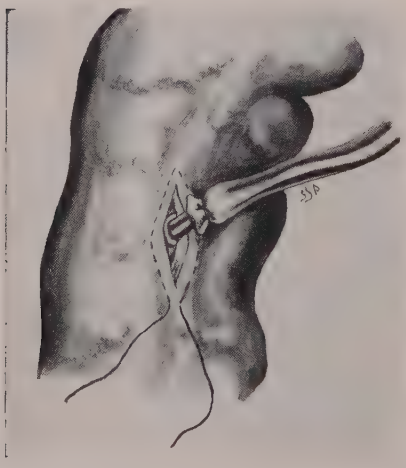


Fig. 4606.—URETERORECTOSTOMY BY THE BOARI BUTTON _ I; _ An axial incision is made through a muscular band of the rectum, in the center of an area previously surrounded by a purse-string suture. The Boari button, around the shaft of which the end of the ureter has been tied, is then inserted within the incision, into the lumen of the rectum.



Fig. 4607.—The Same _ II; _ The margin of the rectal incision has been inverted around the ureter by tightening the rectal purse-string. The union is then reinforced by Lembert stitches of the two structures _ of which one is shown.

Uretero-enterostomy by the Boari Button.—What has been already explained and illustrated as to the technical features and manipulations

in connection with ureterocystostomy by means of the Boari button (v. p. 463) apply to the present operation. In Fig. 4606 the proximal end of the dilated ureter has been tied around the smaller end of the button _ the larger end of the button, composed of the two compressed flanges, has been sunk into the bowel through an incision in its wall _ the margins of which are being inverted by a purse-string suture. In Fig. 4607 the purse-string has been tightened and tied _ and the site of anastomosis is being further reinforced by several Lembert sutures.



Fig. 4608.—Tubularized Implantation of the Detached Ureters in the Sigmoid _ Employed in Exstrophy of the Bladder _ C. H. Mayo's Technic; _ Incision of the outer coats of the sigmoid _ puncture of the mucosa of the bowel _ and the threaded end of the ureter (the needle threaded tractor not being here shown) drawn into the lumen of the sigmoid _ after which the outer coats of the bowel will be sutured over it.

Tubularized Implantation of the Detached Ureter Into the Sigmoid _ C. H. Mayo.—This method of procedure is illustrated in Fig. 4608.

IMPLANTATION OF BOTH URETERS, DETACHED, INTO THE RECTUM—DOUBLE URETERORECTOSTOMY

FOWLER'S OPERATION

Description.—Both ureters, separately severed from the bladder, but held parallel by sutures, are implanted into the rectum (double ureterorectostomy) by such special technic as to open obliquely upon an artificially formed valve of mucous membrane, which valve, together with the circular action of the muscular fibers of the intestine, will tend to shut off the ureters and kidneys from ascending infection from the bowel, especially during defecation.

Preparation.—As for median abdominal section _ with especially thorough cleansing of the intestinal tract, and particularly the rectum.

Position.—Patient in the Trendelenburg position. Surgeon to patient's left, generally. Assistant, opposite.

Landmarks _ Incision.—As for median abdominal section below the umbilicus.

Operation.—The sphincter of the anus is first dilated. The abdominal cavity is opened as in ordinary abdominal section. Displace the intestines downward (toward the diaphragm) and laterally, exposing the site of the ureters. Incise the peritoneum over the ureters, from the brim of the pelvis to the bladder, and free, by blunt dissection, the ureters from their bed to this extent. Ligate the ureters near the bladder wall and divide them obliquely upon the side of the ligature toward the kidneys _ the oblique division being at the expense of the under (posterior) surface of the proximal ends of the ureters. (They may be first divided transversely and then the proximal end beveled obliquely as above.)

Incise the anterior wall of the rectum longitudinally in its center for about 7 cm. ($2\frac{3}{4}$ inches) _ the incision being so placed that its center will correspond with a convenient approximaton of the cut ends of the ureters. This incision passes through the serous and muscular coats only. Dissect back, on either side, the serous and muscular coats, exposing a diamond-shaped area of sub-

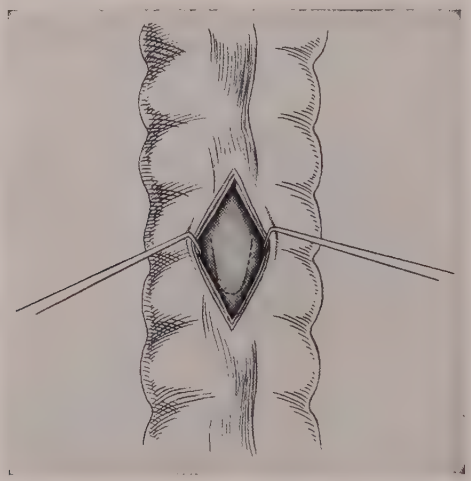
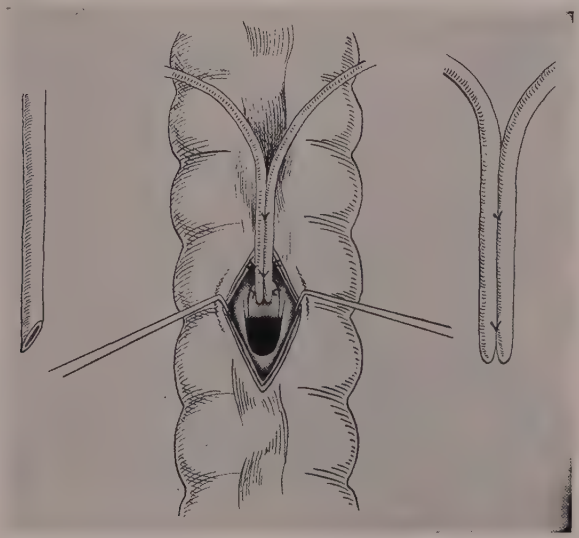


Fig. 4609.—Ureterorectostomy by Fowler's Method _ I; The serous and muscular coats of the rectum are incised and retracted. A U-shaped flap is outlined upon the mucous membrane. (Modified from Fowler.)

mucous tissue _ an Assistant holding aside the margins with temporary traction sutures or tenacula (Fig. 4609). In the lower half of the exposed area of submucous tissue cut a U-shaped flap about 2.5 cm. (1 inch) long, with free end downward, incising through the mucous membrane into the lumen of the rectum. Turn the free end of this flap upward and outward upon itself, so that the apex will point to the base, and the mucous surface will be uppermost _ forming a flap with mucous surface upon one side, and submucous upon the other _ and suture the two surfaces of the reflected flap (Figs. 4610–4612) together along their lateral aspect. (This suturing, however, is not shown in the picture.)

Unite the two ureters upon their inner aspects by two or three interrupted fine gut sutures passed through their fibrous and muscular coats, one placed near their free end, the second about 2 to 2.5 cm. ($\frac{3}{4}$–1 inch) above, and a third may be similarly placed above the second, if there be room. The ureters will be thus so united as to leave the obliquely beveled ends pointing posteriorly. The two parallel, united ureters are now so placed upon this flap of mucous

and submucous tissue that their obliquely beveled surfaces will lie undermost, and in contact with the normal mucous surface of the reflected end of the



Figs. 4610–4612.—URETERORECTOSTOMY BY FOWLER'S METHOD – II; The U-shaped flap is incised and turned upward. The two beveled ureters are connected by two sutures, and then sutured to the mucous flap. (Modified from Fowler.)

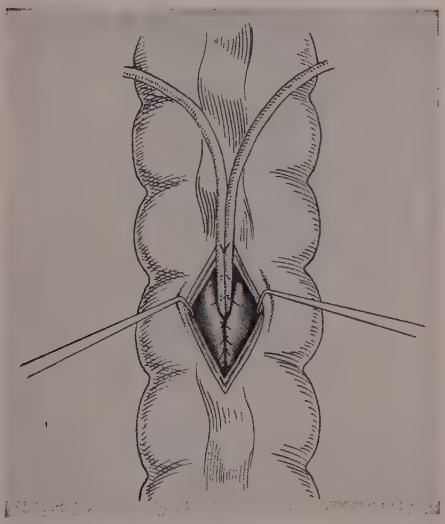


Fig. 4613.—URETERORECTOSTOMY BY FOWLER'S METHOD – III; The mucous flap and attached ureters are then buried within the bowel by suturing the margins of the opening through the mucous membrane. (Modified from Fowler.)

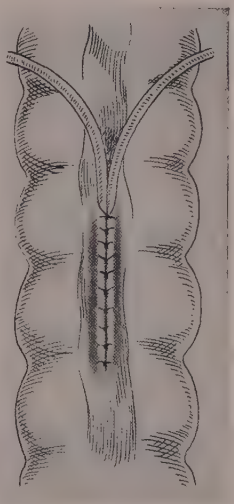


Fig. 4614.—URETERORECTOSTOMY BY FOWLER'S METHOD – IV; – The ureters and mucous flap are still further buried by suturing the edges of the incision through the serous and muscular coats. (Modified from Fowler.)

flap – and with their tips in apposition with the upper part of the reflected flap (so as to leave ample free flap below to serve as a valve). Suture the free

ends of both ureters to the mucous flap by fine gut sutures passing through only the fibrous and serous coats of the ureters, and well into both thicknesses of the mucous flap. The ureters are also sutured above to the submucous tissue of the flap.

The suturing having been completed, carefully push the mucous flap and attached ends of the ureters back into the rectum. Then suture together, with continuous, or interrupted catgut, the edges of the opening through the submucous and mucous coats left by the flap, continuing the suturing upward a little beyond the base of the flap, and beneath the ureters, until the furrow caused by approximating the edges has been obliterated (Fig. 4613). Suture together the edges of the serous and muscular coats of the rectum with interrupted silk or chromic gut, thus further burying in the tips of the ureters, and also burying in that portion of the ureters lying obliquely between the submucous and serous coats, insuring an oblique passage between the rectal coats of about 3 cm. ($1\frac{1}{4}$ inches). One or two of the sutures, in this line of suturing, should include the outer coats of the ureters (not entering their lumen). The outer coats of the rectum, in this line of suturing, should be well sutured around the ureters at the site where they pass between these coats (Fig. 4614).

Temporary drainage should be provided. Otherwise the abdomen is closed as usual.

Comment.—A permanent valve is thus formed, with a mucous surface to the ureter, and a mucous surface to the lumen of the gut, thus closing the ends of the ureters as the bowel distends with combined feces and urine, aiding the control and safety from infection _ which the oblique passage of the ureters through the rectal wall further helps.

Various other methods of intestinal implantation have been done. Maydl transplanted both ureters, including an elliptic portion of the trigone of the bladder, into the rectum or sigmoid flexure _ thus retaining the natural functioning of the ureteral openings (v. i.).

IMPLANTATION OF BOTH URETERS, TOGETHER WITH THEIR VESICAL ENDINGS AND ADJACENT BLADDER WALL, IN ONE PIECE, INTO THE SIGMOID COLON

MAYDL'S OPERATION

Description.—In this procedure the ureters are not divided, but the ureters intact, together with not only their vesical openings, but also an oval of immediately adjacent full thickness of bladder wall, are transferred from their normal position, and implanted into the incised anterior wall of the sigmoid colon.

The operation involves the sacrifice of the bladder, as where that viscus must be excised _ or in some cases of exstrophy of the bladder.

This technic is considered the best method of implantation of the ureters into the intestinal tract _ and, by some, as the only warrantable procedure for this purpose _ due to the fact that, owing to the simultaneous transferal of the undetached normal vesical orifices of the ureters, ascending infection of the urinary tract, from the intestinal tract, less frequently occurs than by any other method _ that is, the protective mechanism against infection, even under such unfavorable conditions as the implantation involve, is the best that is available.

Preparation _ Position _ Landmarks _ Incision.—As for median abdominal section _ and as for the special major operation, of which the implantation of the ureters into the sigmoid is the final step.

Operation.—In the present description the excision of the bladder is

supposed to have preceded — as described under Excision of the Bladder (v. p. 597) so that only the technic of the implantation will be here given. The bladder is excised, up to an oval strip representing the trigone, with the vescial orifices of the ureters.

The sigmoid colon is brought into the field — the ease of accomplishing which is increased by the added room secured through the previous removal of the bladder. An axial incision is made through the anterior longitudinal band of the colon — extending, in length, a slightly shorter distance than the longest measurement of the bladder-flap — and passing, in depth, only through the serosa and muscularis — that is, down to the mucosa. The ovoid

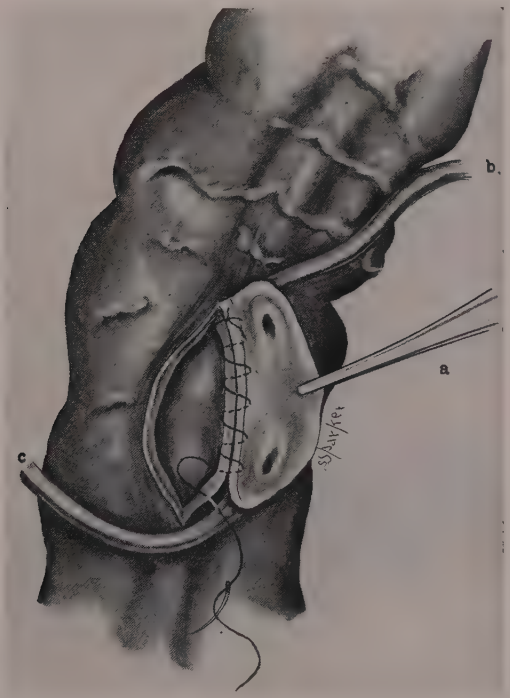


Fig. 4615.—Implantation of the Ureters and Adjacent Bladder Wall, in One Piece, Into the Sigmoid Colon — Maydl's Technic — I: — a, Excised portion of the bladder, with its attached ureters, b and c, showing their vesical openings, being sutured to the margin of the sigmoid, which has been axially incised down to, but not through, the mucosa. The bladder-graft has been somewhat twisted upon itself, from a transverse to an oblique axis.

flap of the bladder wall, with attached ureters, is then brought into relationship with the raw surface of the colon, made elliptic by the retraction of the edges of the axial incision — and in such a manner as to bring the serous surface of the bladder-flap to correspond with the serous surface of the colon — the ends of the ovoid flap fitting into the apices of the colonic bed — and the ureters in easy and untensed position.

While the flap is steadied in this position, the full thickness of the margins of the flap are sutured to the margins of the colonic serosa and muscularis, entirely along one side, and part of the way on the other (Fig. 4615). Silk is a safer suturing material in this important anchorage — nor does the need for using catgut exist, as in the normal urinary tract. When the anchorage

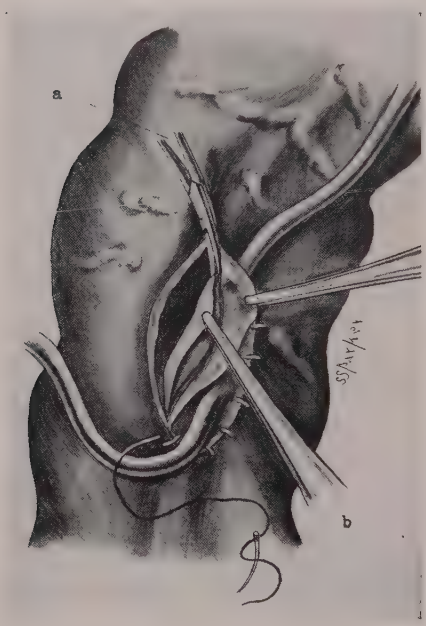


Fig. 4616.—The Same – II; – One margin of the graft has been sutured into the outer coats of the colon by continuous suture applied from within. When this encircling suture is nearly completed the mucosa is excised, a, b, in an elliptic outline, to correspond with the graft – after which the rest of the graft is sutured into the opening.

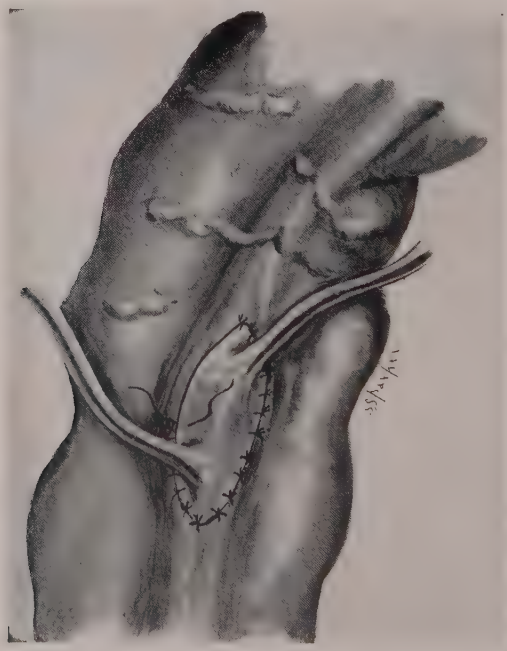


Fig. 4617.—The Same – III; – The through-and-through suturing of the margins previously shown is reinforced by ordinary sutures – or by Lembert interrupted sutures of the serosa of the sigmoid and bladder.

of the vesical flap has proceeded this far, the mucosal bed of the flap site is excised _ being grasped by forceps, and cut out with curved scissors _ Fig. 4616 _ so that the ureteral outlets will not be blocked by it. When this has been accomplished, the final side of the flap is sutured to the corresponding side of the colonic opening (Fig. 4617). When the primary tier of marginal suturing has been completed, this line may be reinforced by an additional line of Lembert suturing _ especially as the original line of stitches become, practically, through-and-through sutures, as soon as the mucosal ellipse is cut out.

In closing the abdomen provision is made for temporary drainage.

IMPLANTATION OF THE URETER UPON THE SKIN — URETEROSTOMY — OR DERMATO-URETEROSTRESIS

Description.—Implantation of the ureter upon the skin of the loin _ whence the urine is drained into a portable urinal. Dermato-ureterostresis,

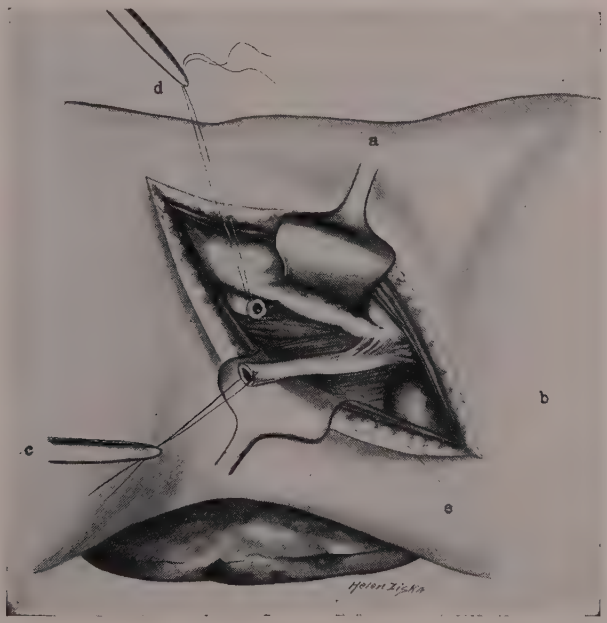


Fig. 4618.—Retroperitoneal Exposure of the Ureter, Followed by Lumbar Ureterostomy or Dermato-ureterostresis _ I: _ a, The unopened peritoneum retracted; _ b, kidney; _ c, proximal end of the severed ureter, about to be brought out into the loin; _ d, distal end of the ligated ureter; _ e, psoas magnus. (The ureter is disproportionately large.)

like uretero-enterostomy, is one of the last resorts in diverting the urinary flow, in such cases as excision of the bladder, or in inoperable ectopia vesicæ _ or, sometimes, as a temporary measure, pending re-establishment of uretero-renal connection. Implantation of the ureter in the loin is preferable to its implantation upon some more anterior aspect of the abdominal wall _ as extension of the ureter through this part of the abdominal cavity is apt to furnish a band for possible intestinal complication.

Operation.—Dermato-ureterostresis may be called for under different conditions:

If the ureter to be implanted be encountered during an extraperitoneal

operation by the oblique lumbar incision – then after doubly ligating and dividing the freed ureter, at the indicated site, the distal end is left *in situ*, and the proximal end is loosened up by blunt dissection (Fig. 4618) sufficiently to free it for the requiste length – and it is then sutured into the skin of the lumbar wound, after, preferably, splitting its end – the remainder of the wound being closed by suture, in the ordinary fashion (Fig. 4619). A temporary

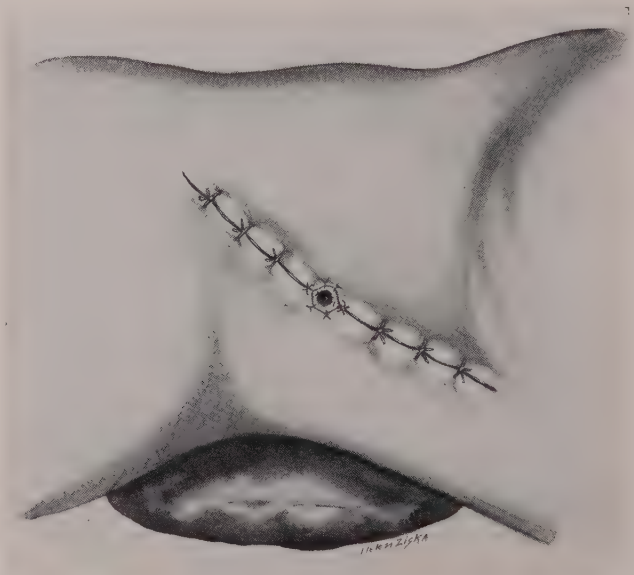


Fig. 4619.—The Same – II; – The distal end of the proximal ureteral segment has been brought out to the skin level and sutured to it, in the act of closing the lumbolateral wound.

ureteral drain (Fig. 4620) should be anchored in the ureter, to prevent kinking, and to maintain the patulousness of the ureter.

If the ureter be encountered in the course of an anterior abdominal, transperitoneal operation, a counteropening is made in the lumbar region, and the ureter implanted in the manner just described – the parietal peritoneum, and the abdominal wound being closed.

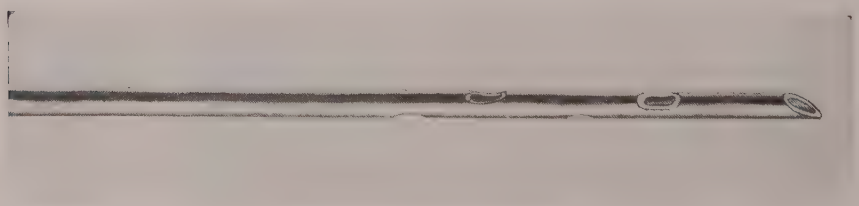


Fig. 4620.—Ureteral Drain.

If an operation be performed for the deliberate purpose of establishing dermato-ureterostresis, the exposure may be accomplished through an incision placed about 3.2 cm. ($1\frac{1}{4}$ inches) above the iliac crest – and extending backward and upward, and downward and forward, as far as needed. After doubly ligating the freed portion of the ureter, the proximal end, further freed, and

with ligature left long, is brought out through a stab incision through the lumbar wall, just to the outer side of the quadratus lumborum _ and the ureter brought through its end split into two flaps, and these sutured to the margins of the skin.

Comment.—The proximal end of the ureter may also be sutured to the skin at the nearest point possible to the bladder, in hope of subsequently doing a plastic operation for the re-establishment of the ureterorenal connection.

OPERATION FOR THE RE-ESTABLISHMENT OF THE URETERAL CONTINUITY, AFTER TEMPORARY ANCHORAGE OF BOTH ENDS OF THE DIVIDED URETER UPON THE SKIN

RYDYGIER'S TECHNIC

In the case of a ureter accidentally or purposely divided during some intra-abdominal operation, and where, for some reason, some more ideal method of re-establishing the ureteral tract cannot be carried out (such as a uretero-ureterostomy), the two ends of the divided ureter are brought out and anchored to the skin margins of the abdominal wound, or into the borders of a specially made wound of the abdominal wall.

Subsequently a plastic operation is performed for the restoration of the ureteral continuity, in the following manner: _ Two parallel incisions are made, near to either side of the incision into which the ends of the ureters were anchored _ as well as parallel with the ends of the ureters debouching upon the skin. Opposite the ends of the ureters (with tissue to spare against contraction) _ which will also be opposite the ends of the two parallel incisions _ an incision is added to each end of each parallel incision at a right angle, extending part way inward toward the opposite parallel incision. In this way two elongated, right-angled flaps are formed, which, upon mobilization along their outer aspects only, are rolled inward (skin, inward _ raw surface, outward) _ after which their inner borders are sutured together, and their ends are sutured to the freshened ends of the ureter _ thus making a skin-lined, connecting tube between the two ureteral ends. Finally, the outlying skin and connective tissue are mobilized _ and sutured over the entire field of operation.

OPERATIONS FOR URETERAL FISTULA

Description.—A fistulous communication between some part of the ureteral lumen, on the one hand _ and the cavity of some viscus, or some peritoneal or cutaneous surface, on the other.

Causes of ureteral fistulæ may be such as the following: _ the result of surgical injuries, knowingly or unknowingly made during operation (accidental ligating, cutting, tearing, crushing, deprivation of blood-supply) _ failure of some form of an anastomosis in which the ureter takes part _ necrosis from pressure of drains _ pressure during childbirth caused naturally or instrumetnally _ as part of injury caused by outside traumatisms _ and the like.

Varieties of Ureteral Fistulæ.—A ureteral fistula may be connected with the abdominal, or with the pelvic portion of the ureter _ more frequently the latter. In the case of a previous operation which is being drained, it generally communicates with the surface along this route. It may open directly into the peritoneal cavity _ and escape detection. Or it may open into any of the hollow viscera with which the ureter has contact, or with which it may be brought into contact in the course of operation _ intestinal tract, bladder, vagina, or uterus. Ureteral fistulæ may be unilateral or bilateral _ and may be simple or complicated (as when combined with a vesicovaginal fistula).

The fistula may be partial, that is, the urine from the kidney goes, in part, *via* some part of the ureter, to the bladder and, in part, is diverted along the new channel, – or total, where all of the urine is diverted from the bladder. The majority of fistulæ are ureterovaginal.

Operative Treatment of Ureteral Fistula.—It may be said, in general, that the treatment of ureteral fistulæ which do not spontaneously close resolves itself into one of three courses – either to anastomose the ureter with some part of itself (v. uretero-ureterostomy, p. 444) or to anastomose the ureter with the bladder (v. ureterocystostomy, p. 457, or, as a last resort, to the large intestine or the skin) – or to remove the kidney. The methods of dealing with such condition as may be dealt with by the more clear-cut procedures of

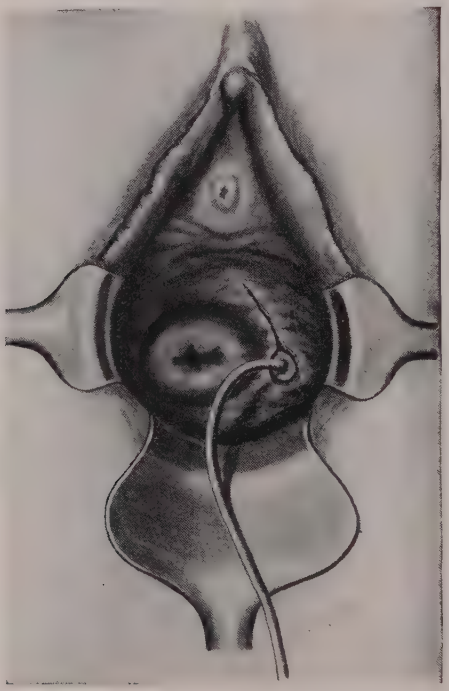


Fig. 4621.—Intravaginal Ureterocystostomy for Ureterovaginal Fistula – I; – The site of the fistula, which a ureteral catheter is seen entering, is outlined by incision – the incision being then continued upward around the cervix, in the direction of the anterior vaginal fornix, toward the bladder. (Figs. 4621–4623 modified from Kelly and Burnham.)

uretero-ureterostomy and ureterocystostomy are described and pictured in detail under those headings. But for the group of cases in which such clearly defined steps cannot be taken for their correction, operative steps must often be improvised which only the peculiar anatomic relationships and pathologic conditions of the individual case will determine – and which must generally be worked out at the time of the exposure of the involved parts. As demonstrative of this latter category, a few illustrative cases of the commonest form of ureteral fistula – ureterovaginal fistula – will be depicted, in which the principles of plastic surgery and personal ingenuity play a large part in the performance of ureterocystostomy for the re-establishment of the urinary circuit.

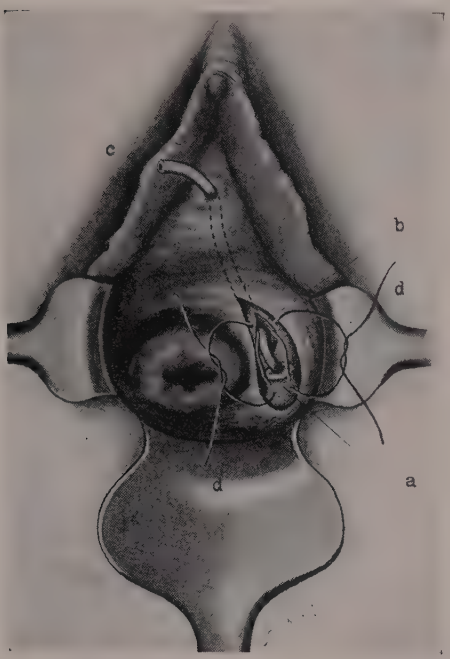


Fig. 4622.—The Same – II: – a, Freed end of the ureter; – b, incision into bladder; – c, ureteral catheter, the eyed end in the freed ureter and the opposite end first introduced into the bladder, through the wound, and thence out through the urinary meatus, through an open-air cystoscope; d, d, two of the non-penetrating sutures of the ureter and bladder so placed as to draw, when tightened, the former into the latter



Fig. 4623.—The Same – III; – The ureter, distended by the catheter, is seen in the bed of the vaginal wound – which sutures are in the act of closing.

In Figs. 4621 to 4623 are seen the steps whereby the ureter communicating with a ureteral fistula, opening into the side of the dome of the vagina, is mobilized by a surrounding incision, which is then prolonged toward the

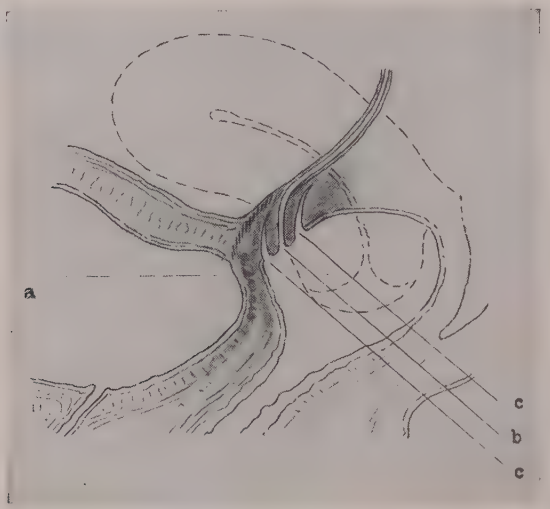


Fig. 4624.—Operation for Ureterovaginal Fistula – I: – a, Obliterated vesical opening of ureter; – b, abnormal opening of ureter into dome of vagina; – c, c, incisions freeing the vaginal ends of the ureter in the ureterovesical and uretero-uterine connective-tissue planes.

anterior vaginal fornix and into the bladder – after which the freed end of the ureter is carried into the bladder incision, upon a ureteral catheter, and anchored there – the vaginal incision being sutured over it.

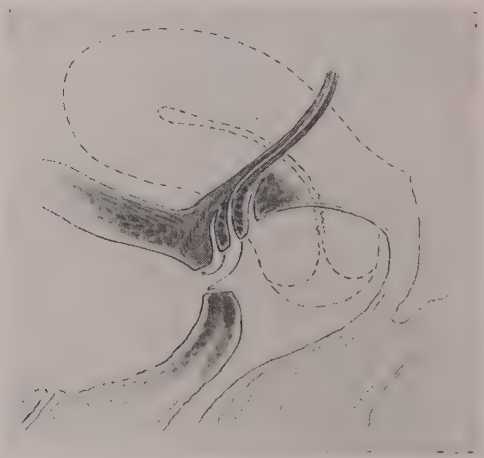


Fig. 4625.—The Same – II: – a, and b, Sites of the ureterovesical and uretero-uterine freeing; – c, site of the incised bladder wall. The two arrows indicate the positions in the floor of the bladder to which the circularly freed ureter will be sutured. Parts are, supposedly, lettered as in preceding picture.

In Figs. 4624 to 4626 are shown the steps for the restoration of the ureterocystic channel by intravaginal operation, in a case where the interrupted ureter debouches into the anterior fornix of the vagina, and the vesical course

of the ureter has been obliterated. In the first section view the end of the ureter, opening into the vagina, is shown mobilized by an encircling incision.



Fig. 4626.—The Same _ III; _ Suturing of the freed ureter to the vesical orifice, restoring the norma channel.

In the second, the adjacent bladder wall is seen incised. And in the third, the end of the freed ureter has been displaced forward and anchored into the bladder incision.

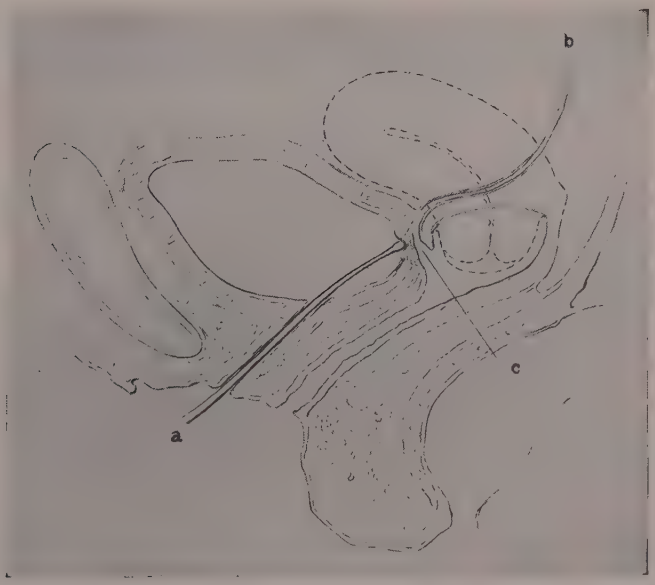


Fig. 4627.—Operation for the Repair of Ureterovaginal Fistula _ I: _ a, Ureteral sound passed into the bladder, through the urethra, and pressed against the scar tissue obliterating the site of the ureteral orifice; _ b, ureter; _ c, fistula opening into the vault of the anterior fornix, to one side of the uterus.

In Figs. 4627 and 4628 a pathologic condition similar to the preceding is encountered _ obliteration of the vesical opening of the ureter, with a new

opening into the anterolateral fornix of the vagina. A sound is passed through the urethra, into the bladder – and through the bladder, to the scar tissue of

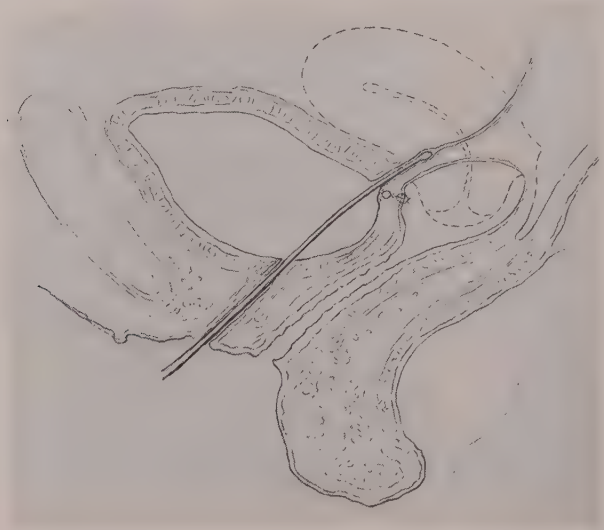


Fig. 4628.—The Same – II; – The ureteral sound (as shown in the preceding figure) is cut down upon in the site of the former ureterovesical opening – freeing the barrier and enabling the sound to pass into the ureter. The ureterovesical aspect of the wound is seen crossed by a buried suture – and the vaginal aspect, by an ordinary suture.

the obliterated ureteral opening. While the sound is thus pressed against the former site of ureteral opening, an incision, from within the vagina, is

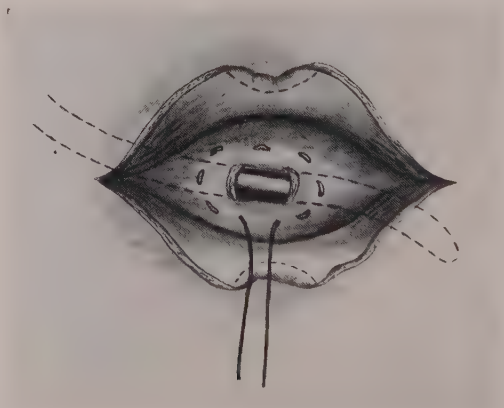


Fig. 4629.—Operation for Ureterovaginal Fistula by Combined Purse-string Suture and Flaps, Following Freshening of the Edges of the Fistula; – A ureteral catheter, previously placed, aids in the steps of the operation. The flaps have been raised and turned back. The margins of the fistulous tract which are to be excised are shown in dotted lines.

made through the vesicovaginal wall, upon the sound, thereby opening up communication between the bladder, ureter, and vagina. The vesicovaginal incision is closed by buried and superficial suturing, uniting the lower lip

of the ureterovaginal fistula to the lower aspect of the vesicovaginal wall _ thus restoring the continuity of the ureterovesical channel.

In Fig. 4629 is a surface view of a ureterovaginal fistula emptying into the dome of the vagina, but still in communication with the patulous ureter above, and the patulous vesical opening of the ureter in front. A ureteral bougie has been passed *via* the urethra in advance of the intravaginal operation. Two flaps of vaginal mucosa and connective tissue are raised from over the site of the fistula and turned to either side. The margins of the fistula are excised from each flap _ and the granulation tissue everywhere excised from the rest of the now shallowed fistulous tract. The margins of the depth of the fistula are brought together by a surrounding buried purse-string suture of fine chromic catgut _ and over this the two flaps are brought and sutured.

URETERECTOMY, IN GENERAL

Description.—Excision of ureter, in whole or in part. Partial ureterectomy is the removal of a portion of the ureter, followed by either a uretero-ureterostomy between the remaining ends, or an implantation of the ureter into some hollow viscus or onto the skin. Complete ureterectomy consists in the removal of the entire ureter _ and implies, of course, the removal also of the corresponding kidney, that is, nephro-ureterectomy.

Ureterectomy may be performed extraperitoneally or intraperitoneally. Extraperitoneal ureterectomy is generally done through the oblique lumbar incision. Intraperitoneal (transperitoneal) ureterectomy is usually carried out through an anterior abdominal section.

Indicated in tuberculosis and suppuration of the ureters. Partial ureterectomy sometimes results accidentally in operating for other conditions.

In total ureterectomy the ureter may be removed at the time of the primary operation for the removal of the kidney _ or secondarily, subsequently to the nephrectomy.

PARTIAL URETERECTOMY

BY OBLIQUE LUMBAR INCISION

Description.—In deliberately undertaken partial excision, as for tumor, the ureter is exposed extraperitoneally by the above incision, and a portion of its extent removed _ followed by a uretero-ureterostomy, where the amount removed is not too great _ or by an implantation, where the amount removed and the site of removal indicate it. A partial ureterectomy is, however, generally accidentally performed, especially in intra-abdominal operations for the removal of tumor.

Preparation _ Position _ Landmarks _ Incision.—As for exposure of the ureter extraperitoneally by oblique lumbar incision, p. 421.

Operation.—If the ureterectomy be deliberately done _ the kidney is exposed _ the ureter isolated by tracing downward from pelvis of kidney _ and is then dissected up from its bed by blunt dissection and by carefully peeling it away from the peritoneum. A limited portion is now excised with scissors _ after ligating below the point of division _ and clamping with special clamp above. The proximal and distal ends are then freed up sufficiently to enable the gap formed by the excision to be bridged, if the interval be not too great. The ends being brought together and a uretero-ureterostomy (preferably by Van Hook's method, see p. 451) being done _ or a ureteral implantation performed. If the gap be considerable, the proximal end must be implanted into some hollow viscus, or upon the skin.

TOTAL NEPHRO-URETERECTOMY BY SINGLE OBLIQUE, LUMBO-INGUINAL, EXTRAPERITONEAL INCISION

Description.—In complete or total nephro-ureterectomy the kidney and entire ureter are removed. The procedure is generally resorted to in extensive tuberculous or suppurative disease of the kidney and ureter, or for chronic fistula of the ureter. While the operation may be performed by the transperitoneal route, the retroperitoneal approach is usually chosen. Although the excision of the kidney does not necessarily imply the removal of the ureter, total excision of the ureter necessitates the removal of the corresponding kidney.

Preparation _ Position _ Landmarks _ Incision.—As for exposure of the kidney and the entire ureteral tract through the retroperitoneal route by the oblique lumbo-iliac incision (v. pp. 421–425, and Fig. 4533).

Operation.—The kidney and its ureter are exposed in the manner described and pictured in the references above quoted _ and the initial step of the operation, the removal of the kidney, is conducted as described and pictured at pp. 403–406, and in Figs. 4525 and 4526.

Instead of first excising the kidney separately it is usually best to retain the connection of the kidney with the ureter for the convenience of manipulation _ although, in complicated cases, involved by extensive adhesions, large tumor masses or pus processes, the kidney may be first dealt with and excised, as though its removal alone were the object of operation _ and the ureter then either removed immediately after, or as a secondary operation. The pivotal point, in the beginning of the operation, is the exposure of the renal pedicle and the double ligation, followed by the division of the renal vessels. The distal aspect of these vessels may be clamped _ but more room for manipulation is secured if double ligation of the vessels be performed, with division between them.

After ligation and division of the renal vessels, and aided by retention of the ureter to the kidney _ and the downward extension and deepening of the lumbo-iliac incision, to the peritoneum _ the peritoneum is carefully freed by blunt dissection from the posterolateral abdominal wall _ and, unopened, and together with the contained intestines, is displaced inward by retraction _ while the ureter is freed also by blunt dissection from its adherence to the peritoneum. This extraperitoneal freeing is continued on down the ureter to its vesical end, where it is clamped proximally, ligated distally, and divided between, with cauterization of the distal end. During these steps much aid is given by the control over the ureter secured in the exposure of its renal end. Finally, drainage is established in this long, deep wound _ which, elsewhere, is closed by layer suturing.

Comments.—In cases where there is no contraindication to continuing the lengthy procedure at one sitting, the operation may be prolonged and the ureter removed, immediately following the removal of the kidney _ but if, on the other hand, it be evident that the patient will be jeopardized by continuing the operation to its end, then it is wiser to remove only the kidney at the first séance _ closing the wound in part, with drainage, and subsequently, when the patient's condition is better, remove the ureter.

In other instances, it may not be evident, at the time the kidney is removed, that the ureter requires removal. And this necessity may not be present until an obstinate ureteral tuberculous or suppurating fistula _ or tubercular or purulent infected urine demonstrate the need.

OTHER METHODS OF PERFORMING TOTAL NEPHRO-URETERECTOMY

Total Retroperitoneal Nephro-ureterectomy by Disconnected Lumbar and Inguinal Incisions _ Kelly.—This method has been worked out in order to avoid the long oblique or other type of incision extending nearly half-way around the body, so largely in vogue. First, the usual oblique lumbar incision is made over the lumbar trigone, for the removal of the kidney and

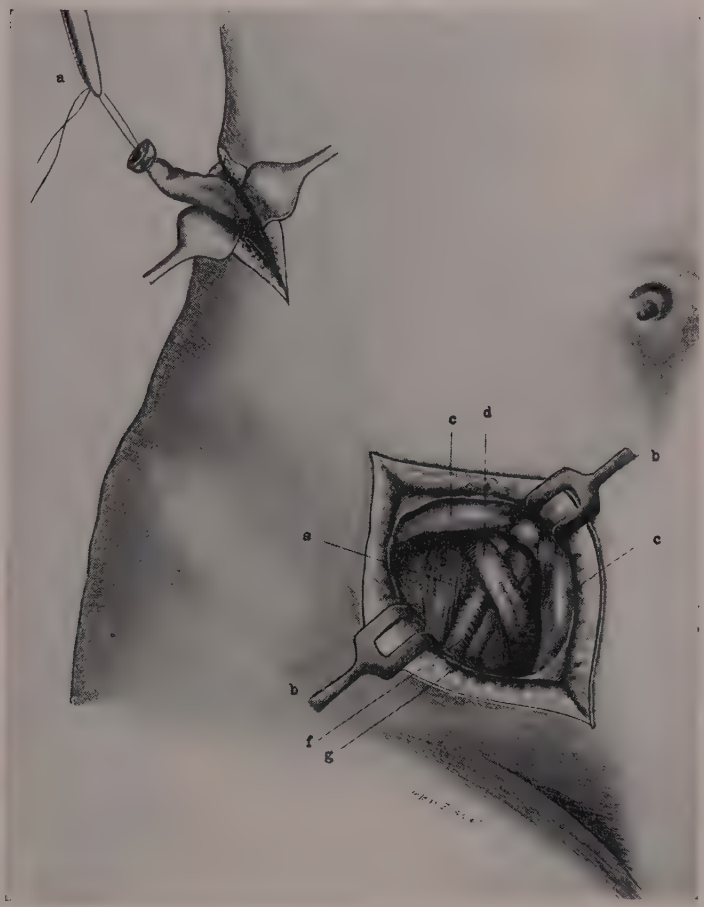


Fig. 4630.—Total Retroperitoneal Nephro-ureterectomy by Disconnected Lumbar and Inguinal Incisions _ I _ Kelly: _ **a,** The ureter has been exposed through a lumbar incision (in connection with the removal of the kidney) _ the distal end ligated _ and the upper part of the ureter drawn out through the lumbar wound; _ **d,** the lower part of the ureter is exposed subperitoneally, through the abdominal wound, **b, b,** as it crosses the iliac vessels, **f, g;** _ **c, c,** retracted peritoneum; _ **e,** psoas magnus muscle.

the securing of the proximal end of the ureter (v. p. 403). Through this incision the kidney is exposed, its vessels ligated, the ureter strongly ligated, and the kidney excised. The end of the ureter is sterilized and drawn out of the lumbar wound (Fig. 4630, **a**). Through the lumbar wound, and while the ureter is kept tensed, it is freed by digital blunt dissection as far down its bed as can be reached through this incision. A second incision is then

made, either along the outer border of the corresponding rectus muscle – or parallel with Poupart's ligament and with the nerve trunks of the abdominal wall (v. Fig. 4630, **b**, **b**). The second exposure may be by a muscle splitting type of operation. The lower part of the ureter is exposed through this incision, after peeling back the parietal peritoneum. By working downward from the upper opening, and upward from the lower opening, the ureter is sufficiently freed, and the way is sufficiently tunneled, to enable the ligated proximal end of the ureter to be drawn down through the lower opening, ligated and

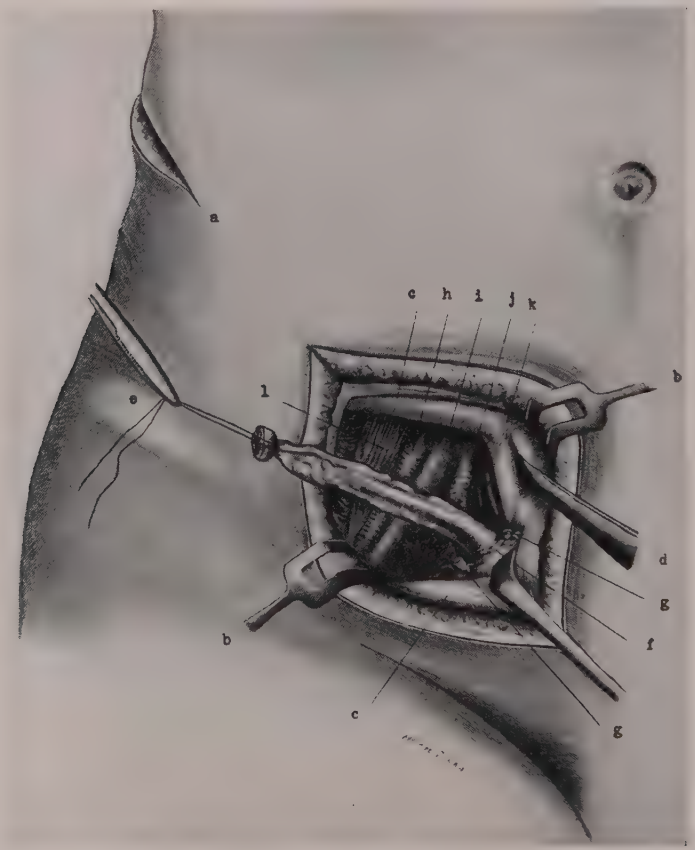


Fig. 4631.—The Same – II: – **a**, Lower end of the lumbar wound, through which the kidney and upper half of the ureter were removed; – **b**, **b**, lower abdominal wound, for the subperitoneal exposure of the lower half of the ureter; – **c**, **c**, **d**, retracted peritoneum; – **e**, bladder end of the ureter, under tension; – **f**, junction of ureter with bladder; – **g**, **g**, ends of ligated artery; – **h**, **i**, external iliac artery and vein; – **j**, **k**, internal iliac artery and vein; – **l**, psoas magnus muscle.

divided near the bladder (Fig. 4631) – or to enable the ligation of the ureter to be performed at the vesical end, followed by its division there, and its withdrawal through the upper, lumbar incision. Temporary drainage may be established through one or both wounds.

Total Retroperitoneal Ureterectomy Upon a Ureteral Guide – Following Total Nephrectomy – Lilienthal.—After removing the kidney a ureteral bougie is passed down the ureter, to the bladder, tying it in at the proximal end. A small incision is next made internal to the anterior superior iliac spine

_ and through this the peritoneum, unopened, is pushed inward, and the ureter, behind the peritoneum recognized, by the inserted bougie. The bougie is removed _ the ureter ligated below _ and withdrawn by blunt dissection through the lower wound.

Total Retroperitoneal Ureterectomy by Means of a Looped Metal Guide _ Following Nephrectomy _ Ransohoff.—After removing the kidney through the usual lumbar incision, such an instrument as the loop of a blunt uterine curet is slipped over the divided proximal end of the divided ureter (which is then clamped). While tensing the ureter the surrounding curet is carefully worked downward over the ureter _ as one frees varicose veins by the corresponding technic _ until the lower part of the ureter is reached. The curet is then directed upward toward the anterior abdominal wall, where it is cut down upon _ after which the ureter is ligated at its vesical end and excised.

CHAPTER LXXVI

OPERATIONS UPON THE BLADDER

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SURGICAL ANATOMY OF THE BLADDER

Description.—The bladder is a musculomembranous sac, mainly situated in the pelvic cavity, between pubes and rectum in male; and between pubes in front, and cervix uteri and upper part of vagina behind, in female _ entirely surrounded by rectovesical fascia, and covered above by peritoneum. Consists of serous (peritoneal), muscular, submucous (areolar), and mucous coats. In infancy the bladder projects above the os pubis and is more of an abdominal organ than in the adult. When empty _ in the adult, the bladder lies deeply in the pelvis, flattened anteroposterteriorly. When moderately distended _ it is rounded and still within the pelvis. When fully distended _ it is ovoid and projects into the abdominal cavity. When greatly distended _ it may extend nearly to the umbilicus. The long axis of the bladder, which inclines to the vertical, runs from a point between the os pubis and the umbilicus (dependent upon the amount of distention) downward and backward toward the tip of the coccyx. The vertical axis is greater in the male _ the transverse greater in the female.

Relations.—(1) Summit.—Connected with abdominal wall by urachus (remains of part of allantois), which passes from apex of bladder, between



Fig. 4632.—Lateral View of the Male Bladder. (Modified from various Anatomies.)

transverse fascia and peritoneum, to umbilicus; obliterated hypogastric arteries, passing upward from side of bladder, on each side of urachus. **(2) Superior,**

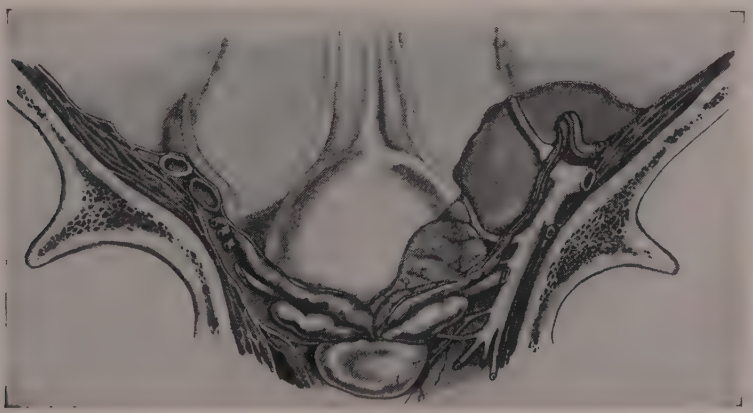


Fig. 4633.—Posterior View of the Male Bladder. (Modified from Spalteholz and Albarran.)

or abdominal surface:—Entirely covered by peritoneum, from summit and obliterated hypogastric arteries to base of bladder; sigmoid flexure (in male); part of vasa deferentia (in male); uterus (in female); small intestine (in both

sexes). (3) **Antero-inferior, or pubic surface:** Uncovered by peritoneum, and separated from the following structures by the cavum Retzii, or prevesical space; triangular ligament; symphysis pubis; levatores ani and internal obturator muscles; abdominal wall (when distended), separated by rectovesical fascia. (4) **Lateral surfaces:** Upper part covered by peritoneum, above the posterior to obliterated hypogastric arteries, lower part, below and in front of obliterated hypogastric arteries, is covered by rectovesical fascia, which separates the lateral surfaces from the levatores ani and surrounds the vesical vessels and nerves; obliterated hypogastric arteries, which cross lateral surfaces obliquely from below upward and forward; vasa deferentia, arching from before backward along subperitoneal aspect of lateral surfaces toward base, crossing obliterated hypogastric arteries, and passing between ureter and wall of bladder; entrance of ureter, at junction of posterior



Fig. 4634.—Lateral View of the Female Bladder. (Modified from various Anatomies.)

and lateral surfaces, about 5 cm. (2 inches) above the prostate; levatores ani and obturator internus muscles. (5) **Postero-inferior surface, or base:** May be subdivided into two parts; (a) Upper, Peritoneal Portion: Rectovesical pouch in male, generally from 1.3 to 2.5 cm. ($\frac{1}{2}$–1 inch) from prostate, up to as much as 5 cm. (2 inches) in marked bladder distention; uterovesical culdesac in female; (b) Lower, Non-peritoneal Triangular Portion: In Male, rests upon anterior surface of second part of rectum, inferior part of vasa deferentia and vesiculæ seminales; its boundaries being; Base, reflected rectovesical fold; Sides, diverging vasa deferentia and vesiculæ seminales; Apex, summit of prostate; In Female, adherent to anterior wall of cervix uteri, and to upper portion of anterior vaginal wall; Neck of Bladder, beginning of urethra.

Ligaments.—(a) **Five true ligaments:** (1) Two puboprostatic, rectovesical fascia and muscular tissue from back of pubic bone to antero-

inferior or pubic surface of bladder, passing over superior surface of prostate gland. (2) Two lateral, _ rectovesical fascia _ from lateral aspects of prostate to sides of bladder and walls of pelvis. (3) Superior ligament, or urachus,

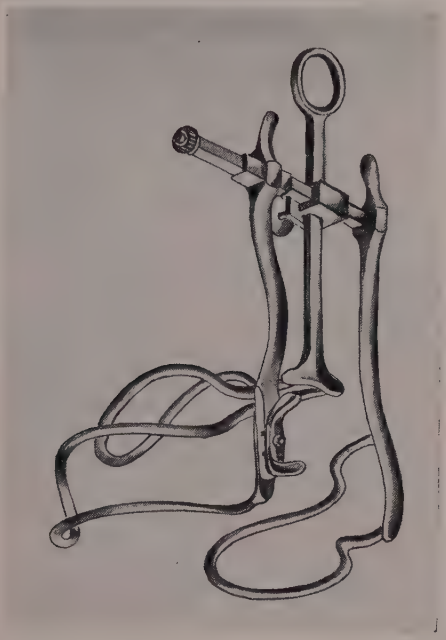


Fig. 4635.—Watson-Wanter's Automatic Bladder Retractor.

_ fibromuscular structure between summit of bladder and umbilicus. (b) **Five false ligaments** (peritoneal folds): _ (1) Two posterior, or rectovesical folds of peritoneum (in male), _ from side of rectum to side of bladder. (2)



Fig. 4636.—Legueu's Bladder Retractor.

Two posterior, or uterovesical folds of peritoneum (in female), _ from sides of uterus to posterior surface and sides of bladder. (The posterior false ligaments form the lateral walls of the rectovesical and uterovesical culdesac,

and transmit the ureters, obliterated hypogastric arteries, with vessels and nerves.) (3) Superior ligament, – fold of peritoneum reflected over urachus and obliterated hypogastric arteries, from summit of bladder to umbilicus.

Relation of Peritoneal Fold to Anterior Abdominal Wall.—The reflection of peritoneum is carried upward as the bladder is distended. The maximum elevation of the peritoneal fold rarely exceeds 5 cm. (2 inches). Sometimes it fails to reach the upper border of the symphysis pubis.



Fig. 4637.—Kocher's Bladder Retractor.

Space of Retzius, or Prevesical Space.—Space between the reflection of peritoneum above and the symphysis pubis below, – and between the bladder posteriorly and the symphysis pubis anteriorly – and occupied by connective tissue.

Trigonum Vesicæ.—Triangular smooth surface at base of bladder – bounded at each posterior angle by the ureteral opening – and at the antero-inferior angle by the urethral orifice.



Fig. 4638.—Direct Electric Head-light.

Orifices of Ureters.—Situated about 3.8 cm. ($1\frac{1}{2}$ inches) from base of prostate gland and beginning of urethra – and are a little less than 5 cm. (2 inches) apart, at either end of the base of the trigone.

Internal Urinary Meatus.—Lies, in the adult male, from 2 to 2.5 cm. ($\frac{3}{4}$–1 inch) posterior to the symphysis pubis, and from 5 to 6.3 cm. (2–$2\frac{1}{2}$

inches) above the perineum. It generally lies opposite some part of the upper half of the symphysis pubis.

Arteries.—Superior, middle, and inferior vesical, and branches from the obturator and sciatic, in the male, _ and the same, with additional branches from the uterine and vaginal, in the female, _ all from the anterior trunk of the internal iliac.

Veins.—Form plexuses around neck, sides and base, and end in internal iliac vein.

Lymphatics.—Accompany the veins and end in the pelvic glands.

Nerves.—From hypogastric plexus of sympathetic, and from third and fourth sacral nerves.

SURFACE FORM AND LANDMARKS OF THE BLADDER

In young children, the apex of the empty bladder is about 2.5 cm. (1 inch) above the level of the symphysis pubis.

In the adult, the apex of the empty bladder is about on a level with the superior border of the symphysis pubis.

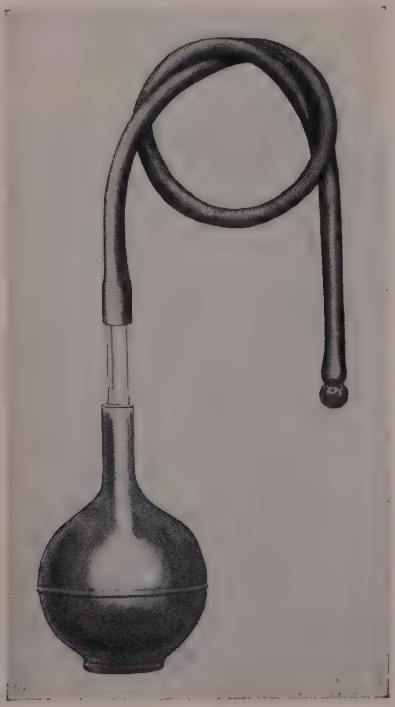
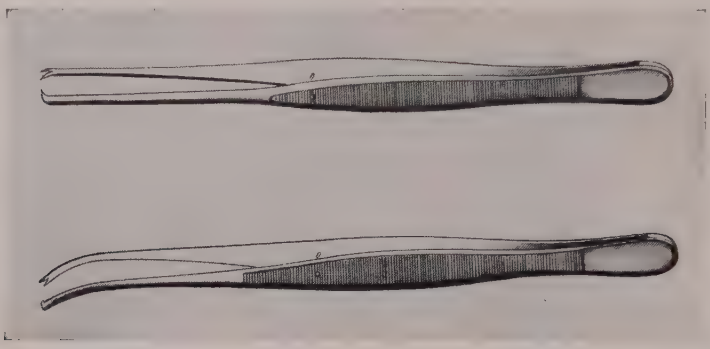


Fig. 4639.—Kelly's Bladder Evacuator.

In marked distention the anterior bladder wall comes closely into contact with the abdominal parietes _ without the intervention of peritoneum between the two.

For the normal extremes of the peritoneal reflection, see Surgical Anatomy, p. 496. For the position of the peritoneal reflection under surgical distention, see General Surgical Considerations, below.

The neck of the bladder is on a level with a line extending horizontally backward from just below the center of the symphysis pubis. Also see position of internal urinary meatus, Surgical Anatomy, p. 492.



Figs. 4640 and 4641.—Toothed Fistula Forceps, Straight and Curved.

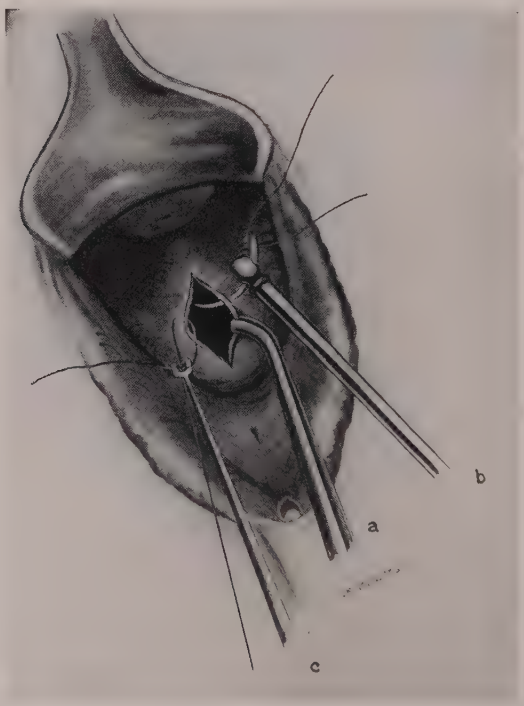


Fig. 4642.—The Same ⎯ II: ⎯ a, Lip of vesicovaginal wound grasped by curved tissue forceps and slightly everted; ⎯ b, curved needle, in long, slender holder, carrying a suture through one lip of the wound; ⎯ c, knot-carrier, carrying up to the lip of the wound a slipknot which has been tied lower down. These two sutures usually control hemorrhage, keep the opening patulous, and render the wound accessible, if necessary.

The depth from the perineal skin to the pelvic floor generally averages from 5 to 7.5 cm. (2–3 inches) in the posterior and external part of the perineum ⎯ and somewhat less than 2.5 cm. (1 inch) in the anterior part.



Fig. 4643.—Kelly's Intravesical Mouse-toothed Forceps.

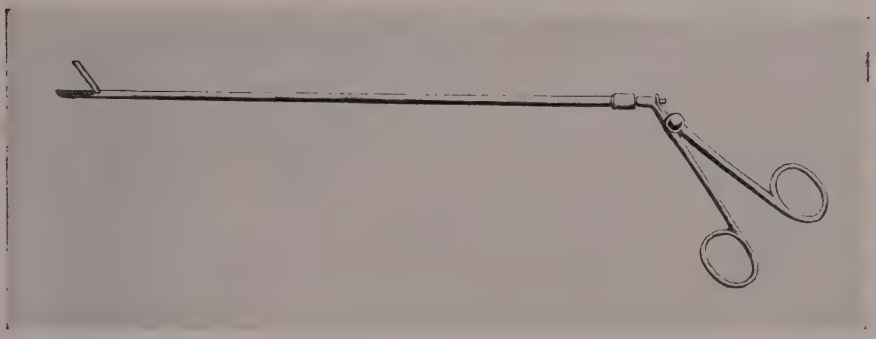


Fig. 4644.—Bransford Lewis' Bladder Forceps for Use Through an Operating Cystoscope.

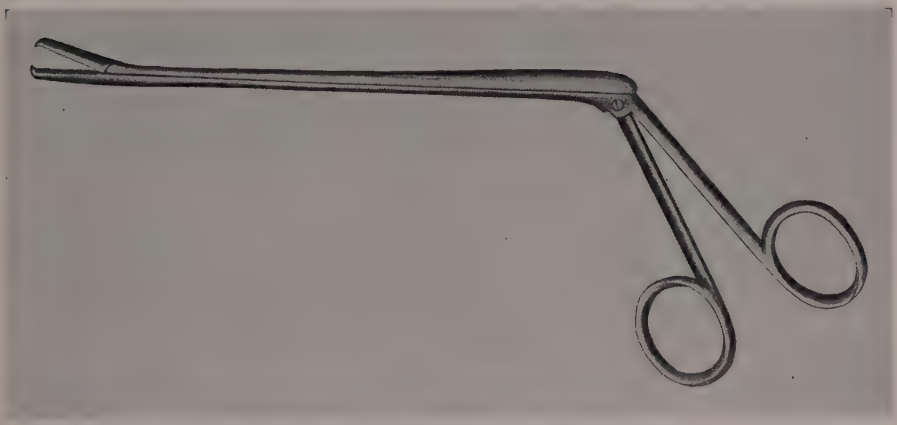
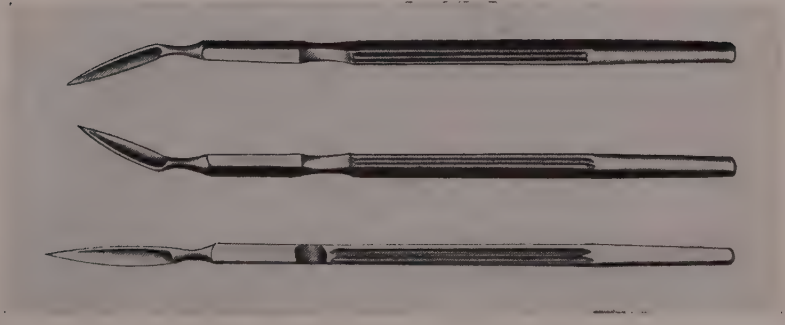


Fig. 4645.—Kelly's Intravesical Alligator Forceps.



Figs. 4646–4648.—Simon's Straight, Right-angled, and Left-angled Fistula Knives.

In the lithotomy position the bladder is about 6.3 to 7.5 cm. ($2\frac{1}{2}$–3 inches) from the perineal surface.

GENERAL SURGICAL CONSIDERATIONS IN OPERATING UPON THE BLADDER

When both bladder and rectum are empty, the apex of the bladder and the peritoneal reflection are slightly below the superior border of the symphysis

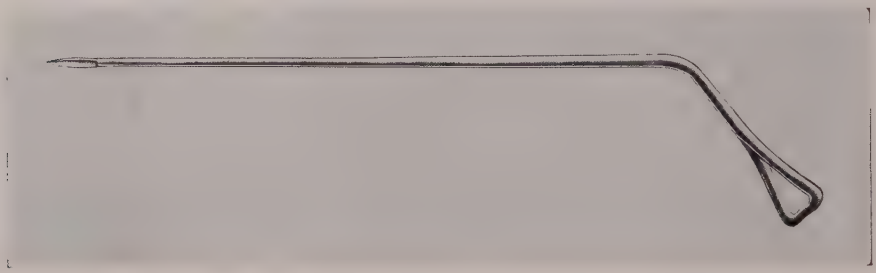


Fig. 4649.—Vesical Knife.

pubis. When the apex of the bladder is as much as 5 cm. (2 inches) above the symphysis and resting against the anterior abdominal wall, the peritoneal reflection is about 2 cm. ($\frac{3}{4}$ inch) above the upper border of the symphysis.



Fig. 4650.—Fenwick's Bladder Knife.

Simple distention of the rectum alone tends to elevate the base of the bladder without correspondingly elevating the non-peritoneal prevesical space.

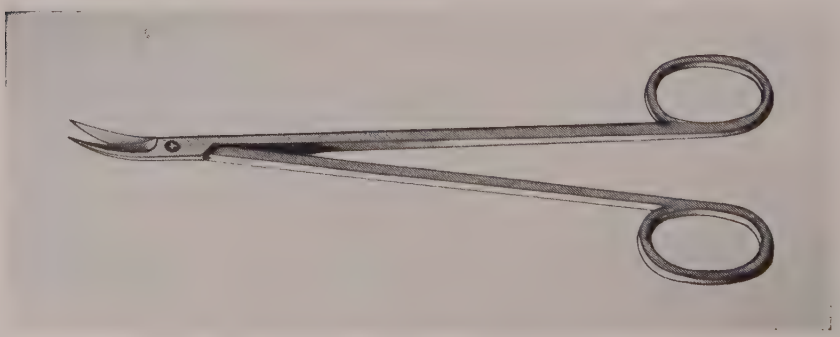


Fig. 4651.—Kelly's Fistula Scissors.

When the rectum is distended by a rubber bag filled with air or water, the prostatic portion of the urethra is elongated, and the bladder is thereby raised out of the pelvic cavity and the peritoneum pushed upward. The maximum elevation of the non-peritoneal prevesical space is obtained by distending the

rectum first and then distending the bladder. The rectal bag is first filled with about 10 or 12 ounces of fluid _ and then the bladder is filled with about 8 ounces. Thereby an additional space free of peritoneum is secured in the anterior line. The amount of space uncovered by peritoneum which is thus ordinarily secured generally amounts, altogether, to about 7.5 cm. (3 inches). The bladder, however, is often first filled _ and up to 15 ounces may be used.

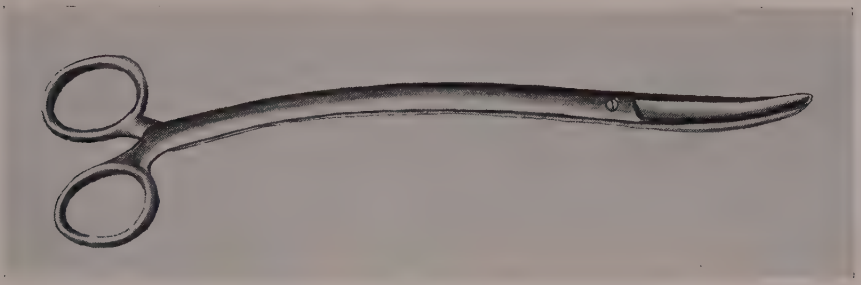


Fig. 4652.—Zuckerkandl's Double-curved Bladder Scissors.

Gray states that after distending the rectum with 420 c.c. water _ and then filling the bladder with 500 c.c. _ the bladder will be elevated by the rectum sufficiently to make an interval between the lower peritoneal reflection and the upper border of the symphysis equal to 8.5 cm. ($3\frac{3}{16}$ inches).

As the point of reflection of peritoneum, therefore, is not fixed, and as it sometimes comes down to a level with the upper border, or even below the symphysis pubis, it is never absolutely safe to plunge a trocar directly into the

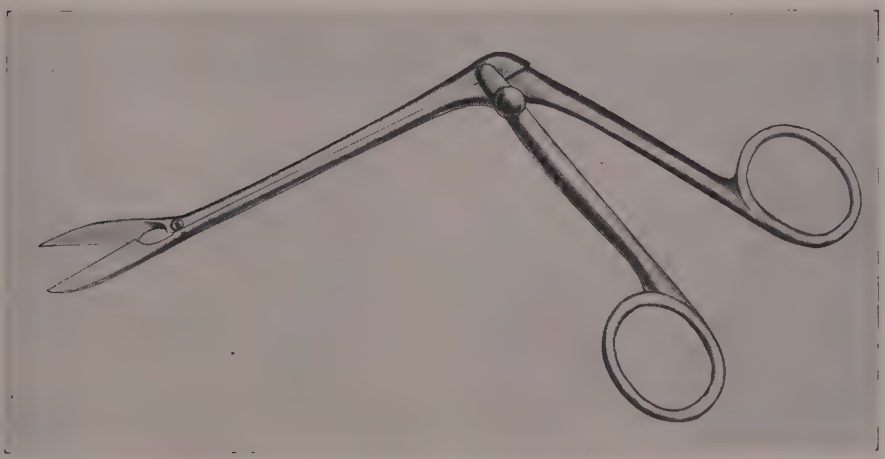


Fig. 4653.—Kelly's Alligator Scissors.

bladder, even immediately above the upper border of the symphysis. It is always better to expose the bladder wall by a limited median incision before using the trocar.

Though not to be recommended, the bladder may be punctured from the rectum, in the lower, non-peritoneal surface at the base of the bladder.

No vessels of any size cross the median line of the abdomen or of the perineum _ the two sites through which cystotomy is generally done.

The artery of the bulb, especially when arising normally, is not generally cut in perineal lithotomy. If the artery of the bulb arises from the accessory pudic it will lie more anteriorly than normal and well out of the way. If,



Fig. 4654.—Zuckerkandl's Double Curved Bladder Scissors.

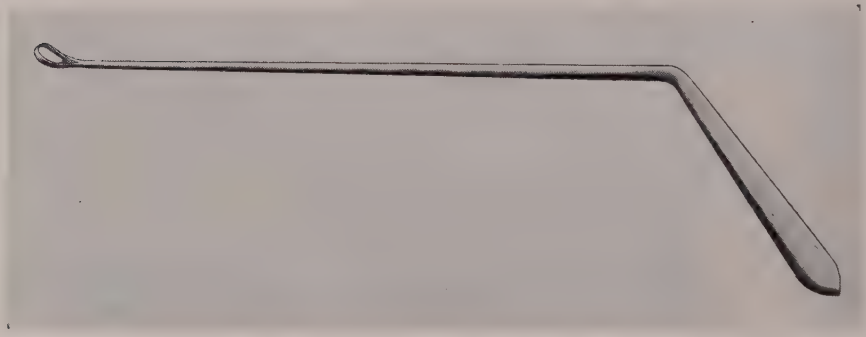


Fig. 4655.—Kelly's Sharp Bladder Curet.



Fig. 4656.—Gruenfeld's Wire Snare for Intravesical Work.

however, it arises from the pudic sooner than usual, it will cross the perineum more posteriorly and will be almost certainly cut.

Perineal incision made into the neck of the bladder should not exceed the limits of the prostate.

The prostatic plexus of veins is likely to be wounded in lateral perineal lithotomy.

The ejaculatory duct is apt to be cut in the same operation if the incision be too far posterior.

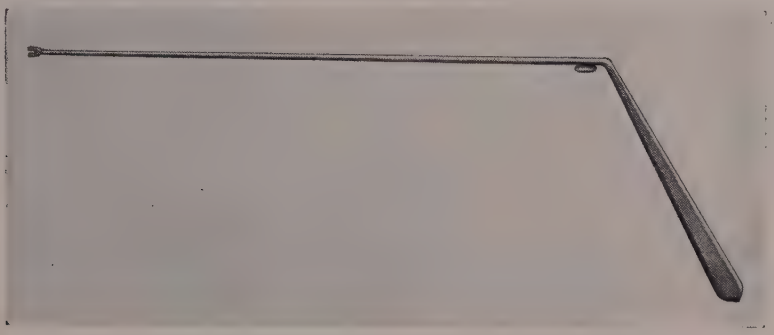


Fig. 4657.—Kelly's Intravesical Knot Tier.

Forms of instruments of service in intravesical operations are seen in Figs. 4646 to 4657.

INTRODUCTION OF THE CATHETER OR SOUND INTO THE BLADDER

Description.—The general method of entering the male bladder by the urethra is the same in all essentials – whether by metallic sounds, catheters, lithotrites, or cystoscopes. Soft instruments are not subject to much guiding, but generally enter the bladder by being simply protruded through the urethral canal without special effort to direct them through the anatomic curves. The passage of instruments in the female is simple.

The object of catheterism, or catheterization, is to draw the urine from the bladder by means of the hollow instrument, hard or soft, passed into it *via* the urethra – or for the purpose of irrigation. The object in passing a sound, or solid metallic instrument, which is generally of rigid metal, or may be of solid though pliable rubber, is usually for the purpose of examination. Other more complex instruments, such as lithotrites and cystoscopes, are passed in the same general manner – with the special modifications characteristic of the technic in the use of the individual instrument.

The passage of sounds will be separately described among the operations upon the urethra (v. Index) – the illustrations and the text of which are of use in the present connection.

Passage of the Metallic Catheter in the Male.—The glans and meatal opening are cleansed – and the parts surrounded by sterile towels – the technic being aseptic throughout. The patient lies supine, near the edge of the table – shoulders slightly elevated – thighs slightly flexed and rotated outward by bending the knees (to relax the muscular tension). The Surgeon usually stands on the left, just above the hips, facing the patient's side.

The sound, or catheter, sterile, warmed, and lubricated, is held lightly in the right hand, between thumb and first two fingers – the handle at first parallel with the abdominal wall. Thus held, its point is introduced into the meatus, the lips of which are parted by the Surgeon's left index and thumb to receive it – the glans and penis being held vertically in the Surgeons's left fingers. As the instrument is pushed onward and downward, the penis is correspondingly drawn upward and over the instrument. As soon as the

instrument is felt to have entered about 10 or 13 cm. (4 or 5 inches), and to be rounding toward the subpubic arch, the handle is gradually elevated until the perpendicular is reached – allowing the instrument to gravitate through the canal and beneath the pubic arch. As this occurs, the handle is continued in its sweep backward directing the point through the triangular ligament – onward through the membranous and prostatic urethra – until the end is felt to glide into the bladder – when the handle will be found pointing directly away from the bladder and slightly downward – having passed through a semicircle in the vertical plane. In withdrawal, the above steps should be exactly reversed. The technic is shown in Fig. 4658.

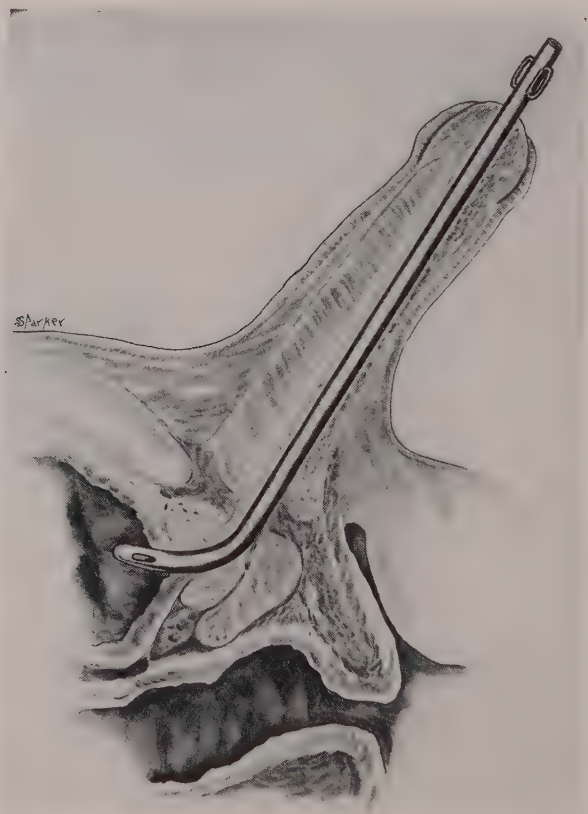


Fig. 4658.—Passage of a Metallic Catheter Into the Bladder in the Male.

Comment.—The sound should first hug the floor of the spongy urethra, until the lacuna magna (on the roof, 2.5 cm. [1 inch] from the meatus) is passed – and then gently hug the roof for the balance of the way through the spongy, membranous, and prostatic urethra.

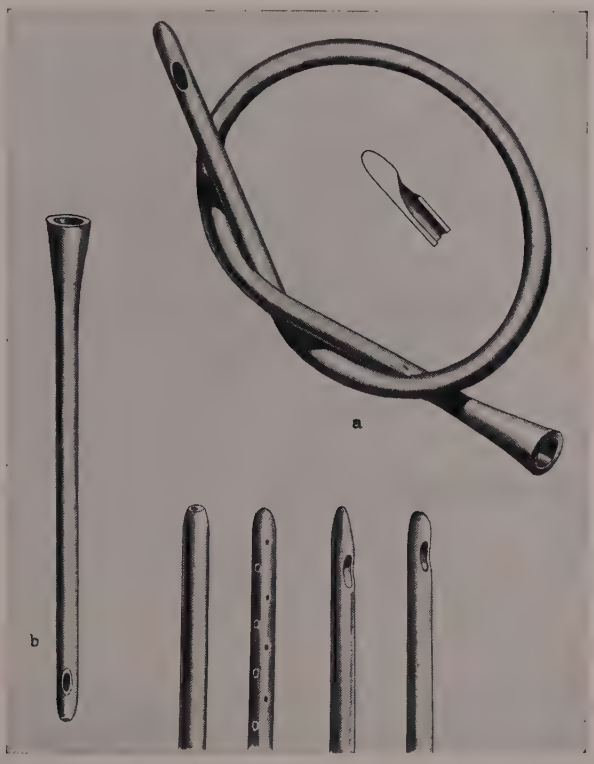
By carrying the handle of the instrument backward and between the thighs too soon, the tip of the instrument is made to hug the roof of the urethra too suddenly and closely, and is apt to lodge against the upper part of the anterior aspect of the triangular ligament, and thus fail to enter the membranous urethra. On the other hand, the instrument sometimes fails to pass the triangular ligament because of lodging against the lower part of the an-

terior aspect of the triangular ligament, the handle not being depressed enough – and, in such cases, is made to glide on by depressing the handle more – or by lifting the lodged point upward by the left index-finger in the rectum, or even by pressure against the perineum behind the scrotum.

The instrument may be at first introduced while held about parallel with the left Poupart ligament – that is, over the left groin – and then swept into the median line as it descends.

If the beak of the instrument revolves readily, the sound is in the bladder – which the flow of urine further corroborates.

At no stage of the technic is force to be used.



Figs. 4659–4661.—Nélaton Soft-rubber Catheters: – a, Male; – b, female. Various tips are shown.

Passage of the Metallic or Glass Catheter in the Female.—The patient lies supine, with hips and knees semiflexed, thighs separated and the parts cleansed. Separate the labia with left thumb and index. Holding the instrument between the right thumb and index, the index extending beyond the end of the instrument, pass the tip of the right index just within the vaginal orifice – withdraw the finger partly, hugging the upper wall of the vagina – and, as the finger glides out of the vagina upon the vestibule, the prominent urethral papilla is felt (about 1.3 cm., or $\frac{1}{2}$ inch) above the junction of the vagina and vestibule – upon which is situated the meatus – into which the instrument is then introduced, and protruded onward into the bladder.

Passage of the instrument should not be undertaken without exposing the parts – as formerly so often done.

Passage of Pliable Catheters in the Male and in the Female.—While the general principles of the technics just described hold in using soft catheters, no active guidance can be given the instruments after they once enter the urethra. After entering the meatus, the catheter is simply carefully pushed onward until the amount of the catheter introduced, or the flow of urine, indicate that the bladder has been entered. Due regard must, of course, be taken of any resistance offered to the onward passage of even a soft catheter – for even with the pliable instrument no force is permissible.



Fig. 4662.—Pezzer Self-retaining Male Catheter – relaxed.

Soft catheters, of both male and female type, are shown in Figs. 4659 to 4661. The tips of such catheters are variously shaped and perforated. All tips should be of velvet softness. The different sizes correspond with the different sizes of the urethral sounds (v. Index).

An ordinary soft catheter is, where difficulty is experienced, often passed by being made more resistant by a wire stilet temporarily held within its lumen – the stilet being withdrawn as soon as the catheter and stilet have entered the bladder.

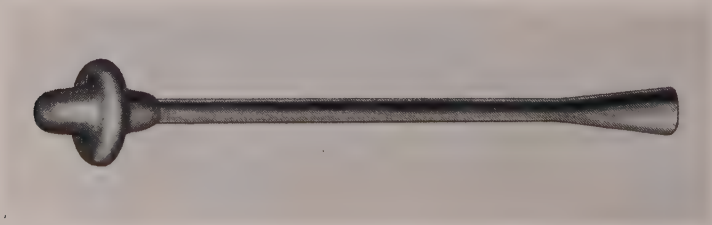


Fig. 4663.—Pezzer Self-retaining Female Catheter – relaxed.

It is sometimes indicated to employ some form of self-retaining catheter – in cases where difficulty of passing the stream of urine through the pathologic urethra or where the condition of the bladder calls for a constant outlet for the urine. Male and female Pezzer catheters are the form of instrument most frequently employed for this purpose (Figs. 4662, 4663). A Malécot fenestrated, self-retaining catheter is seen in Fig. 4664. Their general type is that of a mushroom at the end – and they are all inserted into the bladder

by means of an introducer (Figs. 4665–4670) which holds the rubber instrument outstretched to such an extent, during introduction, that the enlarged end temporarily loses its bulging contour. The introducer, after placing

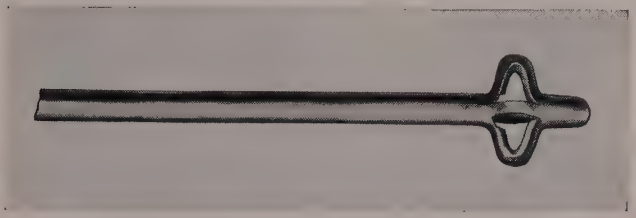


Fig. 4664.—Malécot's Self-retaining Drainage Catheter.

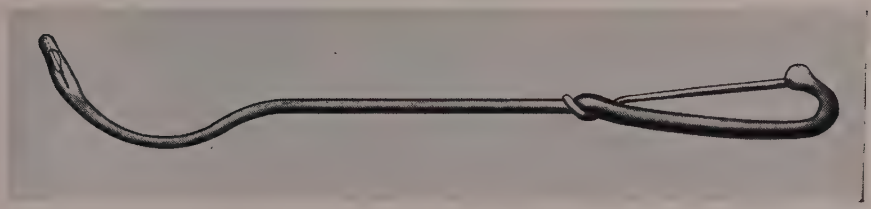


Fig. 4665.—Pezzer Self-retaining Male Catheter – distended by Freudenberg's introducer, ready for passage into the bladder.

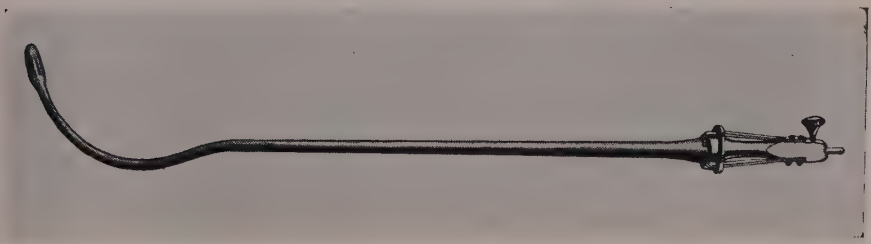


Fig. 4666.—Malécot's Self-retaining Catheter Stretched by a Carlier Introducer – ready for introduction into bladder.

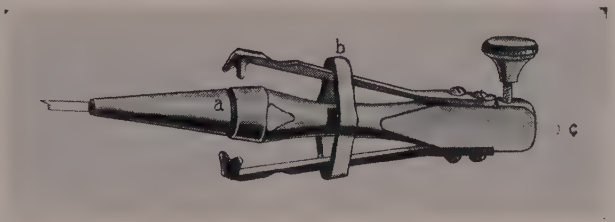
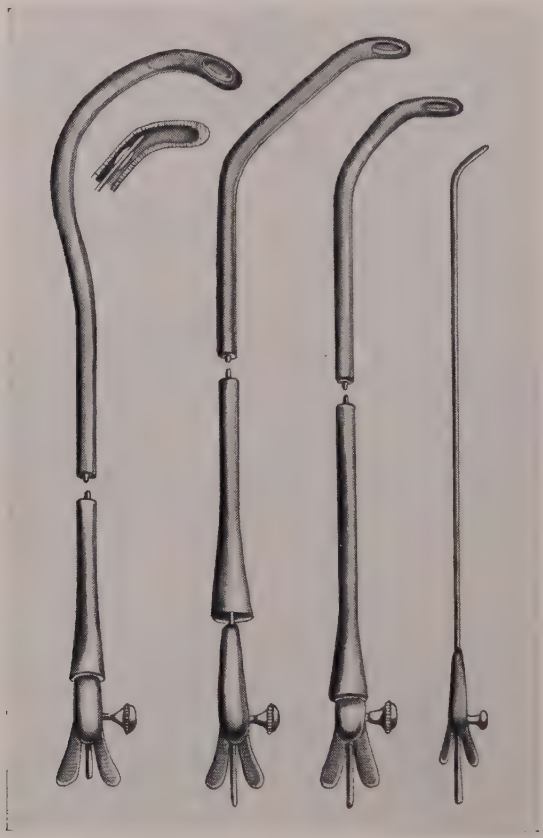


Fig. 4667.—Head of Carlier's Catheter Introducer; – The catheter is clamped at a by pushing down the band, b, after which the entire head, with attached catheter, is drawn as far as desired toward the end, c, where it is clamped to the introducer by the screw, d.

the self-retaining catheter, is withdrawn. Later, in withdrawing the catheter, it is only necessary to exercise a moderate pull upon the free end, when the mushroom is elongated, under tension, and allows the instrument to be drawn out of the bladder and urethra.

In some cases of prostatic obstruction special types of catheters are often used – or an ordinary rubber catheter may be employed with a specially curved or angulated metallic introducer, which trial may have demonstrated



Figs. 4668–4670.—Prostatic Catheters and Introducers.

to be suitable for the obstruction of the individual case – and with this giving the catheter the necessary contour, the catheter and stilet may be introduced, and the stilet be then withdrawn.

VESICAL IRRIGATION AND INSTILLATION

Irrigation of the Bladder.—In vesical irrigation fluid is allowed to flow into the bladder *via* the urethra, or is thrown into the bladder – and then allowed to escape by the same channel.

The chief indications for irrigation are cystitis and as a preliminary to operations upon the bladder. The fluids usually employed, are, – normal saline solution; solution of borax, 1 dram, to water 1 pint (in the presence of acid urine); boric acid solution, from $\frac{1}{2}$ dram to 1 pint, up to a saturated solution (in the presence of alkaline urine); a faint pink solution of potassium permanganate; weak silver nitrate solution; bichlorid of mercury solution, from 1:10,000 to 1:20,000 solution; 1:500 carbolic acid solution, and the like. In conjunction with irrigations urotropin is often employed by mouth.

Bladder irrigations may be variously administered. The funnel method is one of the simplest. A soft-rubber catheter or metallic catheter may be employed in either sex _ or a glass catheter in the female _ with rubber tube attachment, and intervening glass tube connector, to show the flow of fluid. All of the parts are connected before the catheter is introduced into the bladder. The urine in the bladder is allowed to escape, while the funnel is held below the level of the bladder. While the last part is flowing, the rubber tube is

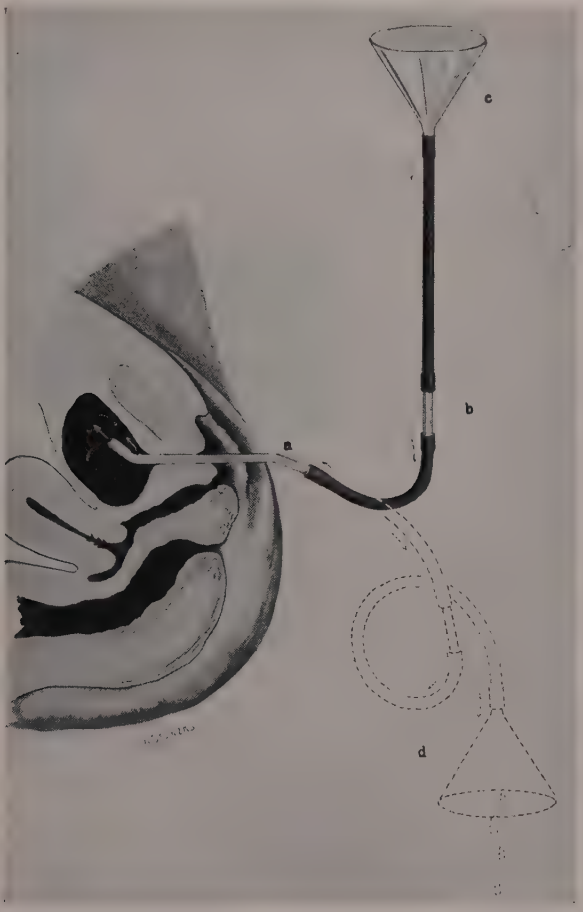


Fig. 4671.—Irrigation of the Female Bladder by Siphonage: _ a, Glass catheter passing through the urethra into the bladder; _ b, glass piece connecting the two portions of rubber tubing; _ c, funnel held above the level of the bladder, delivering the irrigant into the bladder; _ d, same funnel, lowered beneath the level of the bladder, siphoning the irrigant from the bladder.

pinched, and the funnel is raised above the level of the bladder, and filled with the irrigating fluid, from a pitcher. Just before the last of each funnelful flows into the bladder, the funnel is depressed below the level of the bladder, and the amount thrown in, is drawn off _ until, as the last part is coming away, the tube is again pinched, and the funnel elevated _ and this maneuver is repeated until the irrigation is completed. The technic is shown in Fig. 4671.

Irrigation may also be accomplished by a two-way catheter _ during the use of which the inflow and outflow go on simultaneously and continuously. In Fig. 4672 the funnel and tube, shown in the preceding illustration, are attached to the inlet, **a**, and to the outlet, **b**, an outflow tube is attached, to conduct the irrigant into some receptacle.

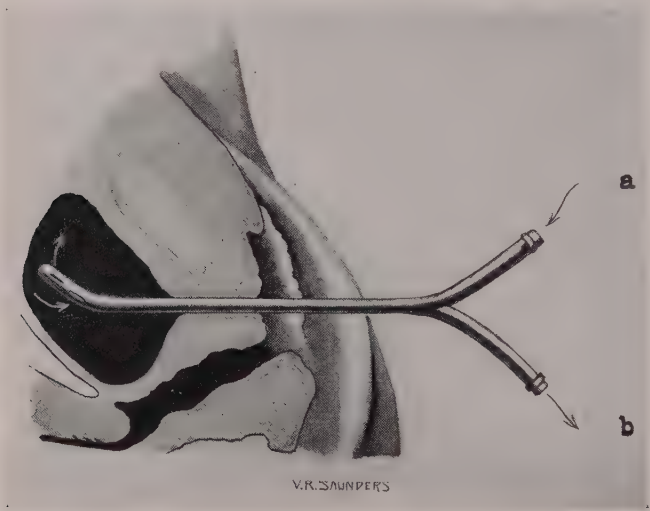


Fig. 4672.—Irrigation of the Bladder by the Double Current Catheter: _ **a**, Inflow channel; _ **b**, outflow channel. The fluid is delivered from a fixed stand, the reservoir being connected by rubber tubing to the inlet channel.

A combined irrigator and lithotomy scoop, for removing stone débris, is seen in Fig. 4673.

Irrigation, again, is sometimes accomplished by means of a piston syringe _ with which fluid is thrown into the catheter passed into the bladder _ and, to allow the escape, the syringe is detached _ and the process repeated. Air, however, is more apt to freely enter the bladder in this method _ unless a two-way stopcock be used, and the syringe not detached.



Fig. 4673.—Mussey's Lithotomy Irrigating Scoop.

Bladder Instillation.—In vesical instillations some medicated fluid usually small in amount, is injected into the bladder by means of syringe and catheter _ and allowed to remain in the bladder for a longer or shorter time, when it may be allowed to pass out again by the catheter which has been retained in the bladder for that purpose _ or the catheter may be withdrawn and the medicated fluid be allowed to remain in the bladder until it is voluntarily passed, or is passed along with the next urination.

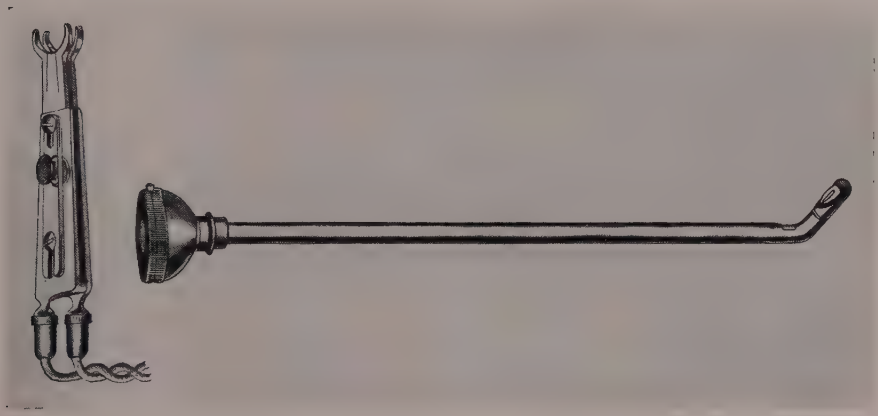
Instillations may be made alone, as the sole procedure — but are generally employed immediately following irrigation of the bladder.

The agents frequently employed in instillations are various strengths of argyrol solution, from 5 to 50 per cent.; solutions of nitrate of silver, from 1:1500 up to 1:100; and other silver salts.

CYSTOSCOPY

Description.—The visual examination, or inspection of the bladder — usually accomplished through a special form of examining instrument, termed a cystoscope, which is generally introduced through the male or female meatus and urethra, into the bladder.

Strictly speaking, however, any ocular examination of the bladder constitutes cystoscopy (though not as the word is usually employed) — such as the view obtained of the interior of the bladder through a cystotomy wound by the naked eye — or the view obtained through a cystoscope introduced through a suprapubic or perineal cystotomy wound.



Figs. 4674 and 4675.—Nitze's Plain Cystoscope — with Switch Controller for Same.

Cystoscopes may be of the simplest type of speculum, as sometimes employed in the female — or may be very complex instrumets, such as some of the male cystoscopes which combine visual, bilateral, ureteral catheterizing, operative, and irrigating features.

In direct cystoscopy the Surgeon examines the interior of the bladder by direct vision — that is, nothing intervenes between the eye and the object viewed. Its chief application is in the female.

In indirect cystoscopy the Surgeon views the interior of the bladder, artifically illuminated by the incandescent globe of the instrument, as a picture reflected and focused by the lenses of the cystoscope. The chief application of this method is in the male.

The details of the technic naturally differ somewhat in the two sexes.

Indirect Cystoscopy in the Male.—Various types of cystoscopes are employed in examining and manipulating within the male bladder by indirect cystoscopy.

A simple form of the Nitze cystoscope, just for examining purposes, is shown in Figs. 4674 and 4675.

For a double catheterizing and irrigating form of cystoscope see Fig. 4677.

An operating type of cystoscope is seen in Fig. 4676.

Some cystoscopes are equipped with a photographing mechanism.

There is a form of male cystoscope constructed for direct cystoscopy in which the window and lamp are upon the convexity of the beak of the instrument _ and one can only see the structures of the bladder directly opposite the window. In the cystoscopes constructed for indirect cystoscopy the window and lamp are upon the inner or concave aspect of the beak. In this latter, more frequently employed type of instrument, the image of the object within the bladder appears inverted upon the lens near the window. From this first lens at the vesical end of the cystoscope the inverted image is transmitted to two additional lenses, near the ocular end of the cystoscope, in the transmission through which the image is righted _ and then, by a third lens, at the ocular end of the instrument, it is magnified and presented to the Surgeon's eye in its natural position.

Cystoscopy, especially in the male, is a more or less complicated technical procedure _ the details of which should be well mastered.

The cystoscope and all of its attachments should be sterilized _ and the method of accomplishing this will differ somewhat according to the make of the instrument.

The instrument must be lubricated _ for which purpose glycerin is generally used _ sometimes alboline.

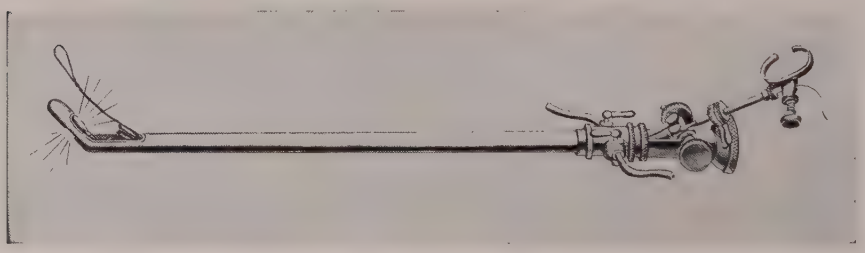


Fig. 4676.—Bransford Lewis' Operating Cystoscope _ with snare carrier and loop *in situ*.

It must be determined in advance that the male urethra is sufficiently patulous for the passage of the instrument, as a mechanical feat _ and sufficiently tolerant of such passage. This may usually be ascertained by the passage of a solid metallic instrument, of at least the size, or larger, than the cystoscope _ and of a form, if obtainable, as near the angularity of the cystoscope as possible. The meatus may have to be slit to admit the instrument. Unless the urethra be passable cystoscopy cannot, of course, be performed.

While cystoscopy can sometimes be performed without analgesia, it can usually be more satisfactorily carried out after the application of a 2 per cent. (rarely 4–6 per cent.) cocain solution to the urethra, vesical orifice, and sometimes to the vesical mucosa. Occasionally cystoscopy is performed under anesthesia.

A soft-rubber catheter is carried into the bladder, by which it is irrigated with sterile saline solution until the returning fluid is clear. When the bladder is empty, from 1 to 2 ounces of a 2 per cent. solution of cocain may be injected into the bladder _ withdrawing the catheter part of the way, and stopping at such a point as to allow some of the fluid to run into the prostatic urethra. After an interval of four or five minutes, for the cocain to act, the bladder is again irrigated with warm normal saline solution, to remove the residue of cocain solution _ leaving, finally, about 6 ounces of clear saline in the bladder _ as the distending transparent medium for the cystoscopic

manipulation. Boric acid solution warm may be used, instead of normal saline _ and sometimes from 10 to 12 ounces are left in the bladder. In an intolerant bladder less fluid may have to be employed. The fluids may be thrown into the bladder from a glass funnel, by gravity, or by a piston syringe.

Where irrigating types of cystoscopes are employed the irrigations of the bladder are often carried on through the irrigating tubes _ doing away with the necessity of preliminary introduction of instruments _ the cystoscope alone being introduced.



Fig. 4677.—Catheterizing the Male Ureters Through the Nitze Double Catheterizing and Irrigating Cystoscope.

In the event of hemorrhage from the pathologic or normal mucosa during cystoscopy 1 dram of a 1:1000 adrenal solution may be thrown into the bladder _ irrigating it away after a minute's stay.

The position of the patient, when all is ready for the introduction of the cystoscope, is usually a sitting posture, in a special chair for cystoscopy, with the body backwardly inclined, the feet in supporting stirrups, with hips flexed and knees widely apart. Some Surgeons place the patient in the lithotomy position. The Operator's position is immediately between the patient's thighs, standing, or sitting, with his eyes upon the level of the urethra.

Having, the last thing, tested the illuminating lamp of the instrument, and lubricated its beak with glycerin, the cystoscope is carefully passed down the urethra _ through the prostatic portion, by lowering the ocular end,

and on through the internal meatus, into bladder. At this point the illumination is turned on, and the cystoscopic examination begun (Fig. 4677).

The interior of the bladder is examined methodically _ not in a haphazard fashion _ and begins nearest the vesical meatus, and of the region above the horizontal plane made by the shaft of the instrument in entering the bladder _ the examination proceeding from before backward. The bladder may be said to be examined in transverse, ribbon-like strips _ the roof and sides of the upper dome first _ and the floor and sides of the base last. On first entering the bladder the immediate vicinity of the vesical meatus is examined _ the beak of the cystoscope being turned first to the right and then to the left _ after which the beak is advanced somewhat further into the bladder, and then swept to right and left, like a search-light sweeps the dome of the skies with an arc of light. When this onward progress and side-to-side revolution of the

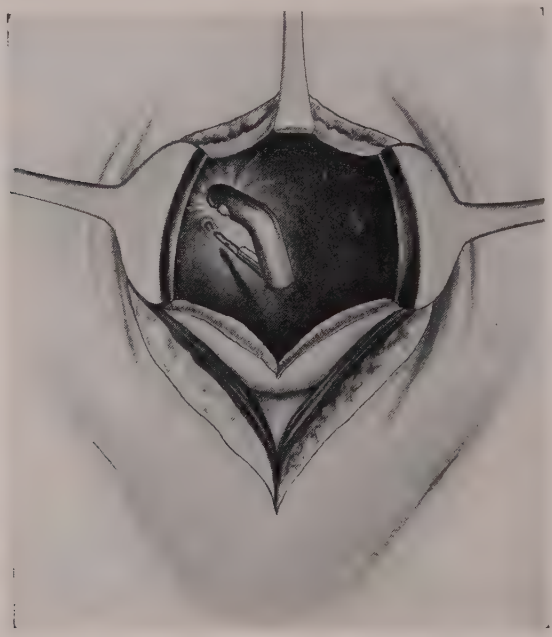


Fig. 4678.—Locating the Ureteral Orifices by Inverting the Beak of the Cystoscope.

eye of the instrument has been carried out until the posterior wall of the bladder is reached, the instrument is drawn back toward the outlet of the bladder until the beak impinges against the internal meatus, when the beak is turned through a half-circle, and the examination of the floor of the bladder begun _ and this is carried out, from side-to-side, while passing backward, just as the dome of the bladder was examined. In these maneuvers the ocular end of the instrument may be raised, or lowered, as indicated, for the purpose sought. The ocular end of the instrument may also be swung from side to side. These manipulations will bring the illumination and the window of the cystoscope upward, downward, and lateralward in the many relationships and nearer contacts with the bladder wall that may be indicated in a detailed examination. A marking on the ocular end of the instrument (usually a small knob) will always correspond with the direction of the window in the beak of the instrument.

The ureteric orifices are usually located either by depressing the trigone of the bladder with the beak of the instrument (Fig. 4677) _ or by inverting the beak (Fig. 4678). If it be desired to catheterize the ureters, first one ureteral catheter is projected from its recess and carried into the corresponding ureteral orifice and up the ureter as far as indicated _ and then the beak of the instrument is shifted slightly to the opposite side, and the second ureter catheterized in a similar manner. If difficulty be experienced in locating the ureteral orifices, adopt the following maneuver, _ recognize the trigone of the bladder by its darker color, coarser structure, and by the vessels radiating outward from the internal orifice of the urethra _ then locate the transversely running ureteric ridge (formed by the interureteral muscle) _ which, if not marked as a ridge, is marked by the transition of the darker color of the trigone into the lighter color of the surrounding mucosa _ and follow this ridge, or



Fig. 4679.—Kelly's Bladder Speculum and Obturator.

color line, outward, first on one side, and then on the other _ until, where it is most prominently marked, before fading into the bladder wall, a reddish, slit-like opening, the ureteral orifice, will be found, on turning the beak of the instrument about one-eighth of a circle to the right for the right orifice, and *vice versa*. Sometimes relatively prominent vessels will lead to the ureteral orifices.

If there be difficulty in finding the ureteral orifices, 30 minims of a 4 per cent. solution of indigocarmin may be injected into the muscle tissue of some convenient locality _ following which, in about twenty minutes, little streams of blue dye will issue from the openings of the ureters.

The portions of the bladder which are the most difficult to satisfactorily examine are the anterior, posterior, and posterosuperior walls _ requiring considerable manipulation of the instrument to bring them into the field.

Movable foreign bodies and calculi are usually readily detectable _ unless

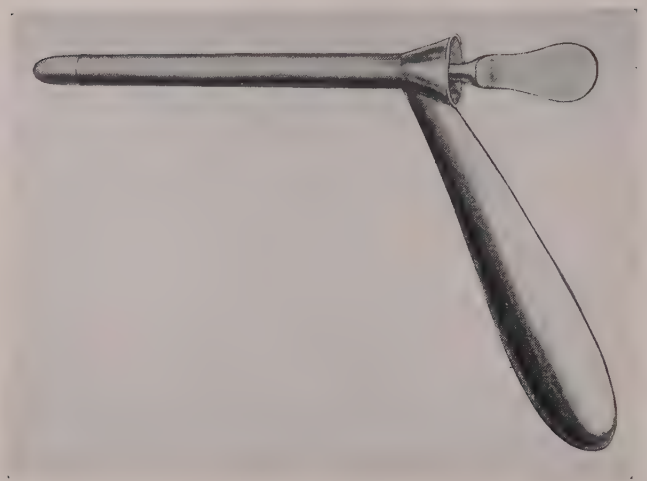


Fig. 4680.—Kelly's Bladder Speculum and Obturator – of later type, medium size, assembled.

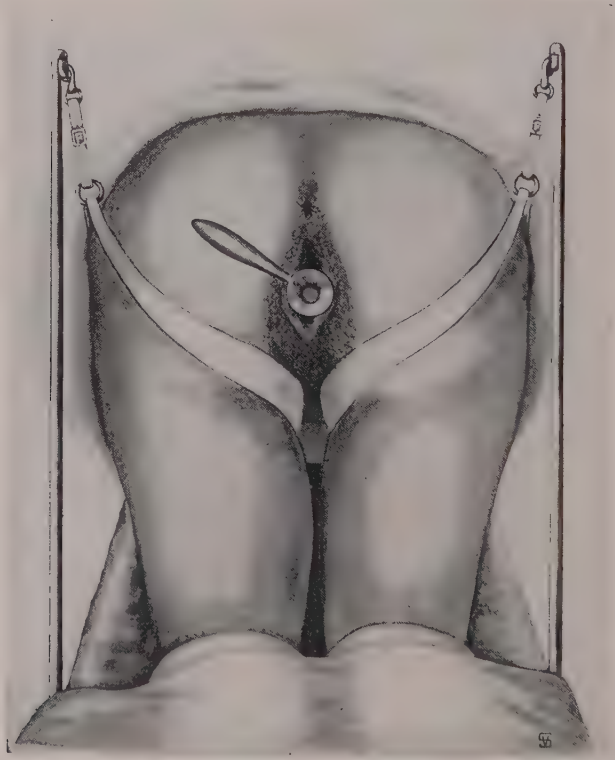


Fig. 4681.—Use of the Kelly Vesical Speculum, with the Patient in the Knee-chest Position – supported between uprights and suspending bands – affording direct intravesical view.

in immediate contact with the window of the instrument. If the object to be examined be stationery, the instrument alone remains movable, and the technic is easier.

The situation and nature of tumors are largely determinable.

More accurate information can be gotten about calculi by cystoscopy than by *x*-raying.

Additional information can be secured as to the prostate in conjunction with other pathologic conditions within the bladder – thus determining an operative step for the relief of both, rather than a procedure which might be undertaken for a single one. For instance, it may have been decided to remove a calculus by litholapaxy, or by suprapubic cystotomy, which determination would, upon the discovery of an enlarged prostate, probably be changed to a perineal operation for the simultaneous removal of both calculus and prostate.

Differential catheterization of the ureters has been already described and pictured (v. pp. 427 and 429).

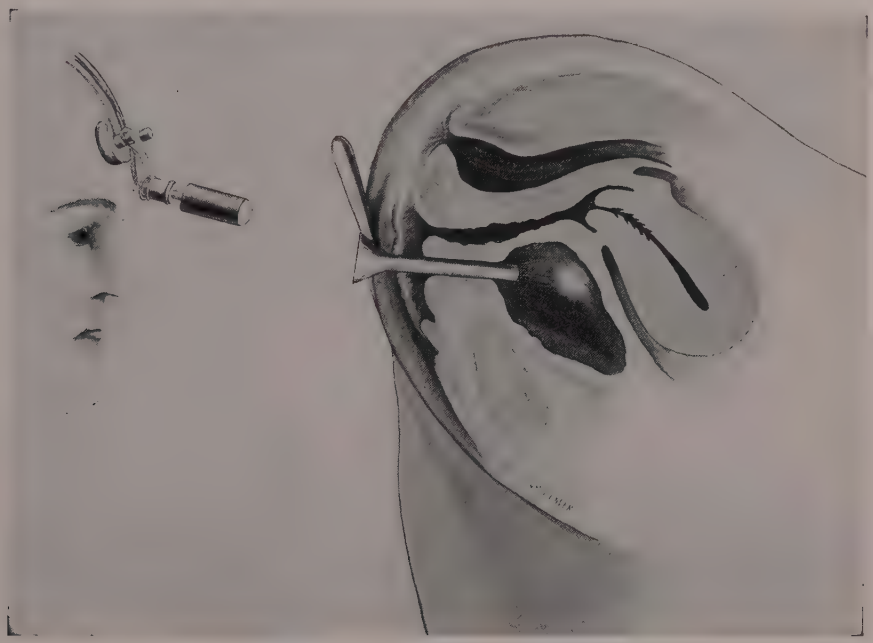


Fig. 4682.—Relation of Vesical Speculum Shown in Axial Section – in cystoscopy in the knee-chest position, in examination by direct illumination.

Finally, in concluding the intravesical examination, the beak of the instrument is turned directly upward – and the cystoscope is withdrawn.

Direct Cystoscopy in the Female by Kelly's Open-air Cystoscope.—The Kelly cystoscope is, practically, a special form of simple speculum with accompanying obturator (Fig. 4679). The latest type of the instrument is made longer and slenderer (Fig. 4680). The view of the bladder is direct, between the eye and the object, without intervening lenses or angles.

The cystoscope is introduced in one of three positions – the knee-chest, elevated lateral, or elevated dorsal.

In the knee-chest position the patient rests at the end of a table or support, upon knees and chest, with thighs vertical, and head turned to one side, so that the chest is as near the horizontal as possible (Figs. 4681, 4682).

In the elevated lateral posture the patient is placed in Sims' left lateral

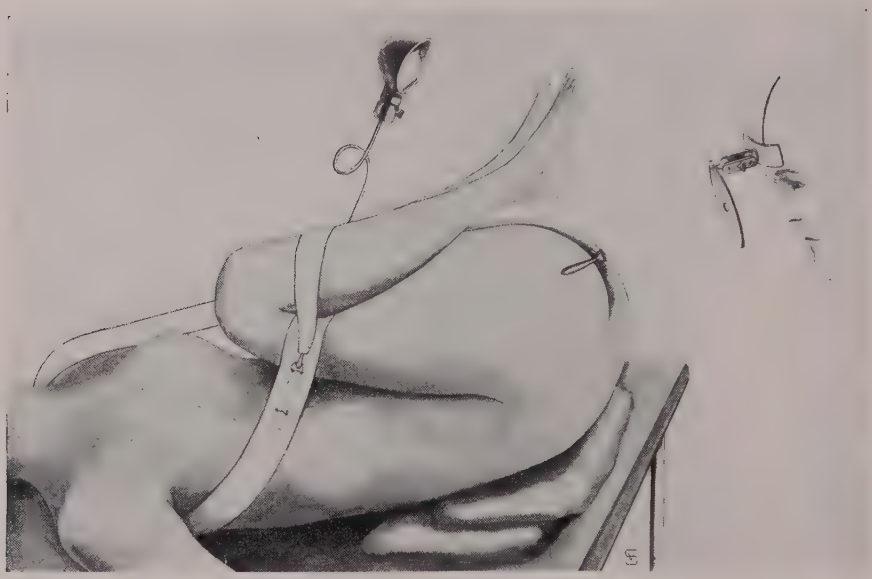


Fig. 4683.—Direct Cystoscopy Through Kelly's Speculum Cystoscope by Means of Indirect Illumination – the patient in the dorsal position, with elevated pelvis, and the thighs retracted by the Kelly-Robb band.



Fig. 4684.—Examination of the Bladder in the Trendelenburg Position – with the patient ready for the introduction of the cystoscope.

position, with a cushion under the left hip. This attitude has been described in connection with the catheterization of the ureters.

In the elevated dorsal posture the patient is placed in a marked lithotomy position, with a cushion beneath the buttocks (Fig. 4683) or in a moderate Trendelenburg position (Fig. 4684).

In the various positions employed the illumination is either direct, from a head light (v. Fig. 4682), or by light reflected from some source by means of a head mirror (v. Fig. 4683).

Preliminarily to the employment of cystoscopy the bladder is emptied by catheter, – irrigated with warm boric acid solution, – and analgesiated, especially if irritable, with about 20 c.c. of a 2 per cent. novocain solution

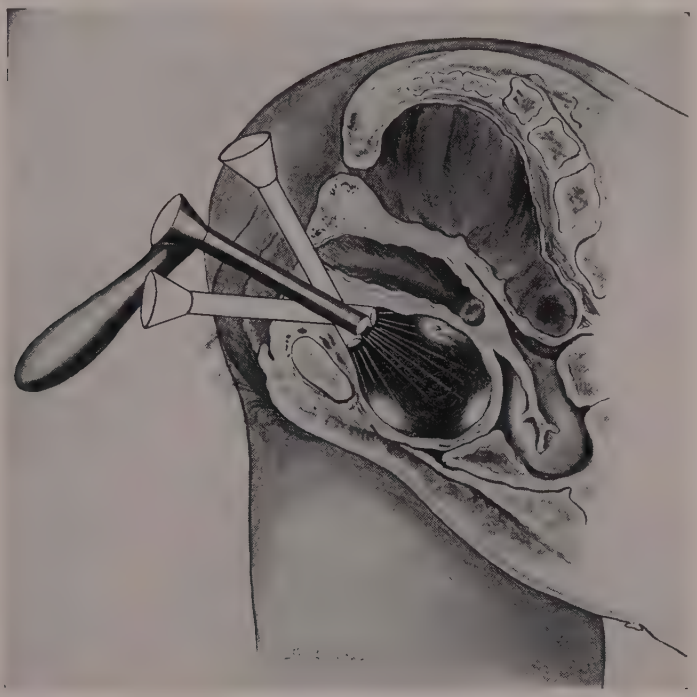


Fig. 4685.—Cystoscopy of the Female Bladder Through Kelly's Open-air Cystoscope – in the knee-chest posture – showing the various positions of the cystoscope in both median and lateral planes. This picture, by inverting the book, may also serve to illustrate, in a modified way, the use of the cystoscope in the dorsal position – in which, however, the pelvis should be elevated.

(which is removed by catheter in about ten minutes). In some instances anesthesia is employed. When all is ready the patient is placed in the elected one of the three positions – here supposed to be the knee-chest.

The urethra is first measured with the conical calibrator and dilator, lubricated with glycerin – and, if necessary, dilated up to about 10 mm. in diameter.

The calculation is made that when the Surgeon is seated his eyes are about on a level with the urethral orifice.

By lifting and separating the buttocks, near the posterior vaginal outlet, air enters the vagina – upon which the anterior vaginal wall drops, thus bringing the wall of the bladder on a level with the line of vision.

The speculum, with obturator inserted, and held between the thumb

and first two fingers with the handle of the obturator downward, is made to enter the urethra _ and is carefully pushed on into the bladder, traversing a curved line around the symphysis pubis _ and finally pointing downward toward the abdomen.

While the obturator is being withdrawn from the speculum, its handle, from pointing downward on introduction, is turned upward, into the fold of the buttocks, and is there steadied by the Surgeon's left hand, or by an Assistant, after the object sought is located. If any urine be found in the bladder, it is removed by suction drainage.

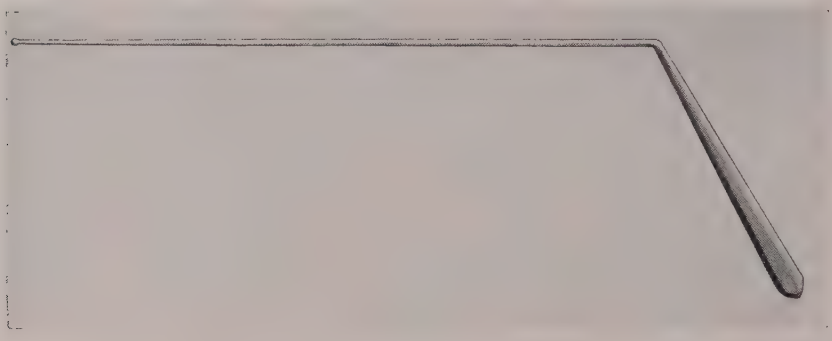


Fig. 4686.—Kelly's Ureteral Searcher

The direct or reflected light is focused down the cylinder of the speculum _ and onto the different walls of the bladder, in turn (Fig. 4685). As in the case of cystoscopy in the male, the examination of the vesical cavity is carried out systematically, but, owing to the non-angularity and to the simplicity of the instrument in the female, is not so difficult a procedure. The structures examined are: the regions of the urethra; the trigone; the ureteral orifices; the right and left walls; the dome; the anterior surface lying behind the symphysis; and the posterior wall. These views are secured by variously manipulating the cystoscope, as suggested in the illustration last quoted. Some of the views obtained are at right angles to the line of vision _ others are seen obliquely.



Fig. 4687.—Kelly's Metal Ureteral Catheter, with Cap.

The localization of the ureteral orifices and the catheterization of these has been described and pictured (v. pp. 427–432). And what has been said upon this subject in connection with male cystoscopy, also bears, largely, in female cystoscopy.

Through this type of open speculum direct intravesical instrumentation may be practised. Such a ureteral sound as that shown in Fig. 4686 _ or a metallic ureteral catheter, of the form seen in Fig. 4687, may be used.

In securing the urine from the two ureters for differentiation _ either one ureter may be catheterized and then the other, or both may be catheterized simultaneously. In the simultaneous catheterization the right ureter may be

catheterized as is shown on the right in Fig. 4688 _ and then the speculum may be shifted to the opposite side, and the left ureter catheterized. Or, as Kelly suggests, after catheterizing the first ureter, the original speculum may be withdrawn, carefully keeping the first catheter in the ureter which it has entered _ and then a slightly smaller size speculum be introduced, leaving the original catheter between the musosa of the urethra and the outer wall of the speculum, and then catheterizing the second ureter through the second, smaller speculum.



Fig. 4688.—Catheterizing the Female Ureters Through the Kelly Open-air Cystoscope _ in the knee-chest position. The right ureter has been catheterized, and the cystoscope shifted leftward to more readily reach the opposite one.

Instead of collecting the individual urines by different ureteral catheters, a special type of urine-collecting speculum has been devised by Kelly (Fig. 4689) which may be introduced and carried directly up to the individual ureteral orifice from which the urine is desired (Fig. 4690) _ and then, after being withdrawn and cleansed, be reintroduced, to collect the urine from the opposite ureter.

The principles are the same, whether the technical details are carried out in the knee-chest, lateral, or dorsal postures _ the special modifications being suggested by the pose of the patient's body in the different cases.

Direct Cystoscopy in the Female by the Luys Direct Vision Cystoscope.—This type of cystoscope is seen in Fig. 4691 _ and is employed in



Fig. 4689.—Kelly's Urine-collecting Bladder Speculum and Obturator _ for collecting urine directly from one or the other ureteral orifice, in the knee-chest position _ the average size of the speculum being 9.5 cm. ($3\frac{3}{4}$ inches) in length, and 10 mm. ($\frac{6}{16}$-inch) in diameter.



Fig. 4690.—Collecting Urine Directly from the Female Ureters _ through the Kelly open-air cystoscope, in the knee-chest position.

the same general way, as to its introduction and manipulation, as is Kelly's open-air cystoscope just described. A type of the instrument for use in the male bladder, perfectly straight, has been successfully employed.

Direct Cystoscopy in the Female by Cullen's Open-air Electric Cystoscope.—This is an angularly beaked instrument (Fig. 4692), electrically illuminated in the ordinary manner of cystoscopes, and provided with an

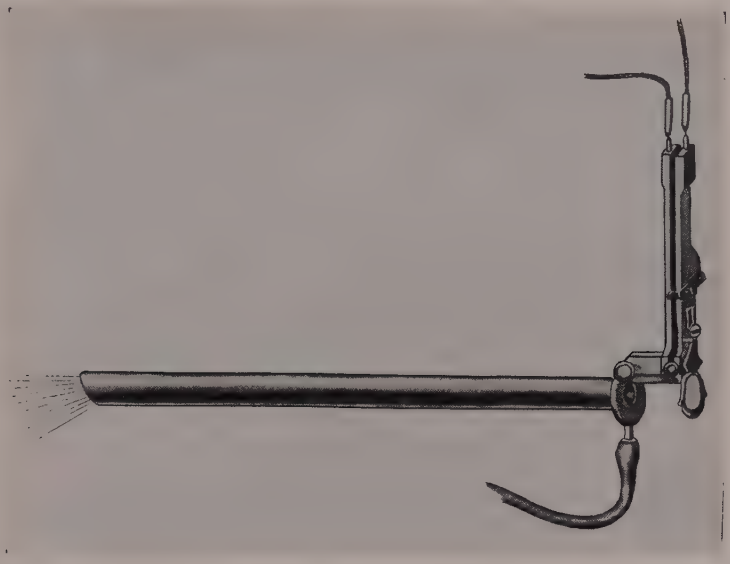


Fig. 4691.—Luys' Cystoscope.

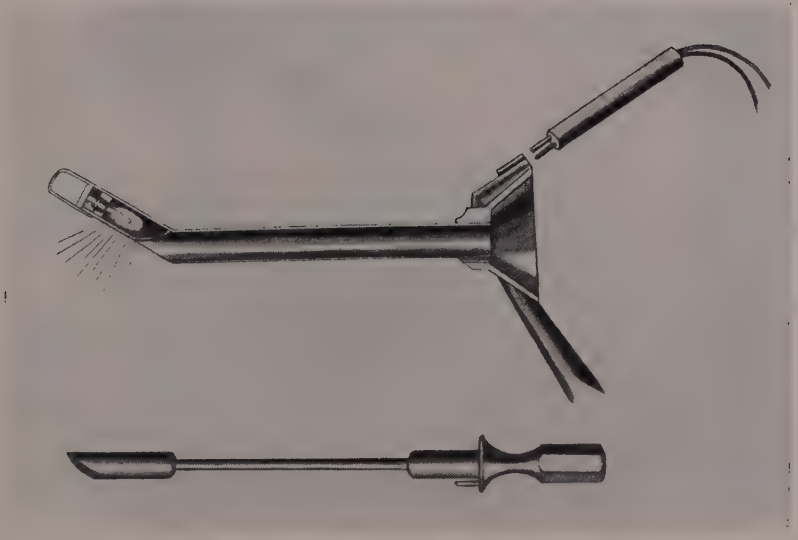


Fig. 4692.—Cullen's Cystoscope, with obturator. (Modified from Kelly.)

obturator. It is introduced with the obturator *in situ*, which is then withdrawn, furnishing a direct, straight view.

Indirect Cystoscopy in the Female.—Cystoscopes of ordinary type,



Fig. 4693.—Exploration of the Female Bladder by Means of the Nitze Cystoscope.

shorter and of simpler construction than those used in the male, may be employed. Such use of the Nitze type of cystoscope is shown in Fig. 4693.

INTRAVESICAL SEGREGATION OF THE URINES

BY MEANS OF LUYS' URINARY SEGREGATOR

Description.—In this method of urinary differentiation a special type of hollow, metallic catheter is carried into the bladder, by which, in conjunction with a rubber diaphragm sprung into position in the middle line, the bladder is partitioned into two halves – the urine from each ureter being passed into its own half of the bladder, and out of the bladder through its own half of the catheter – to be separately collected for examination. The method is applicable in both the male and female.

This technic was formerly frequently employed – but has been largely replaced by the more accurate differentiation of the urines by intravesical catheterization of the ureters.

Technic of Intravesical Segregation.—The bladder is irrigated and several ounces of warm boric acid solution left in its cavity. The parts of the Luys segregator are pictured and described in Fig. 4694. The patient is placed in such a position as to keep the floor of the bladder the lowest – a posture between sitting and reclining (and in more of the former attitude than shown in the accompanying illustration). The instrument is introduced through the urethra into the bladder in the same general manner that a metallic catheter is – with care to make the convex curvature of the instrument hug the floor of the bladder as closely and snugly as possible, so as to prevent the passage of urine from one side of the bladder to the opposite, either beneath the instrument, or at the anterior or posterior curvatures – and this is further prevented by the marked tendency of the bladder to apply itself to and cling about the metallic limits of the instrument. When the segregator is in place

and all is ready, the rubber "chemise" is so tensed, by control from the handle of the instrument, as to spring into position and form the median partition of

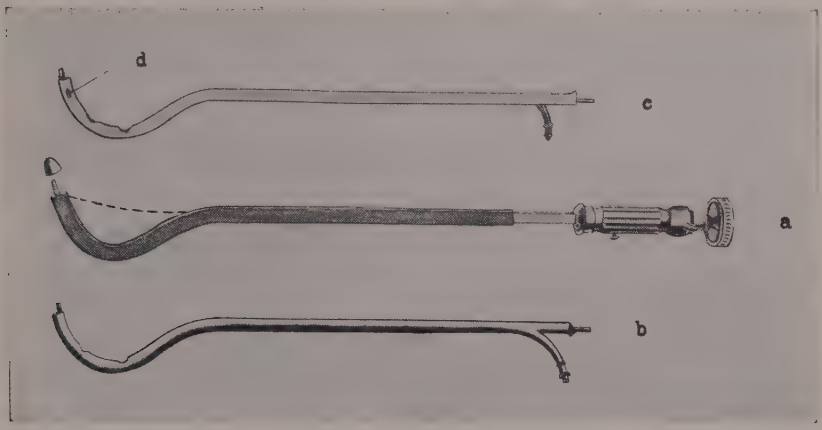


Fig. 4694.—Luys' Urinary Segregator in Separated Parts: _ a, "Rubber chemise," slipped over the shaft of the median piece, which, when drawn toward the handle and clamped in position, is drawn up, opposite the bowed portion, as indicated by dotted lines, thus partitioning the base of the bladder by a median partition, b, left, c, right sides, hollow, to be clamped, at tip and handle, against the rubber tubing; _ d, d, openings through which accumulating urine in the bladder enters the tube of its own side; _ e, tube of exit for urine from the right ureter.

the bladder. All of the fluid left in the bladder is first allowed to escape, together with a little of the oncoming urine _ after which the rest of the urine from each ureter is allowed to flow into its own receptacle, which is

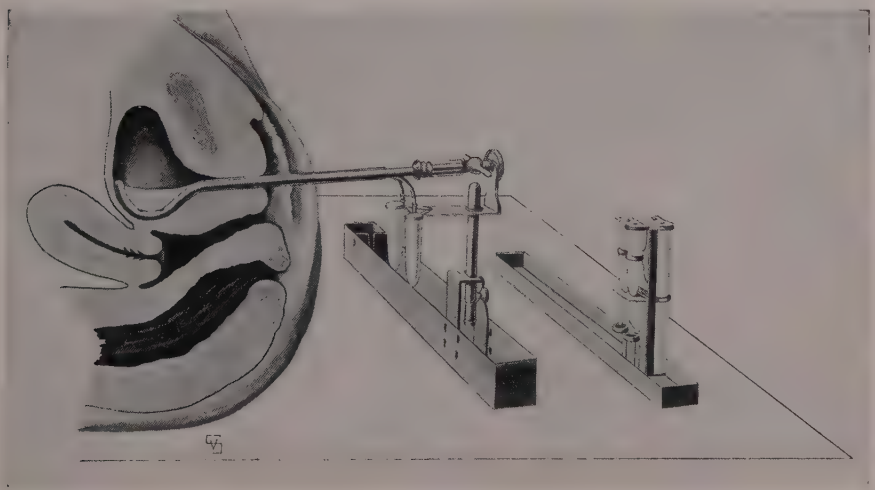


Fig. 4695.—Intravesical Separation of the Urines by Means of Luys' Segregator; _ The instrument is shown introduced into the bladder, with diaphragm spread, supported by its own box, thus converted into a stand. The distended rubber diaphragm, or "chemise," is shown separating the urines being collected from the ureters of the two sides, and conducting the portion from each ureter to the test-tube of its own side.

steadied in the special stand, which serves both to hold these receptacles and to steady the segregator (Fig. 4695).

Upon the completion of the collection the rubber partition is allowed to collapse _ and the instrument is withdrawn.

Cathélin devised another type of intravesical urinary separator, upon the same general principle of expanding a median partition from an instrument introduced into the bladder.

SUPRAPUBIC PARACENTESIS OF THE BLADDER

Description.—The puncture of the distended bladder, in the median line, just above the symphysis pubis, by trocar and cannula, or by aspiratory syringe _ for the purpose of relieving acute urinary distention _ as an emergency measure, either to withdraw the urine of a functional retention (where for some reason catheterization is not available), or to temporize until organic retention can be relieved by operation.

The puncture is usually made through the intact skin. Sometimes the skin alone is incised into the subcutaneous connective-tissue plane and the puncture then made. In other instances the distended bladder wall is actually

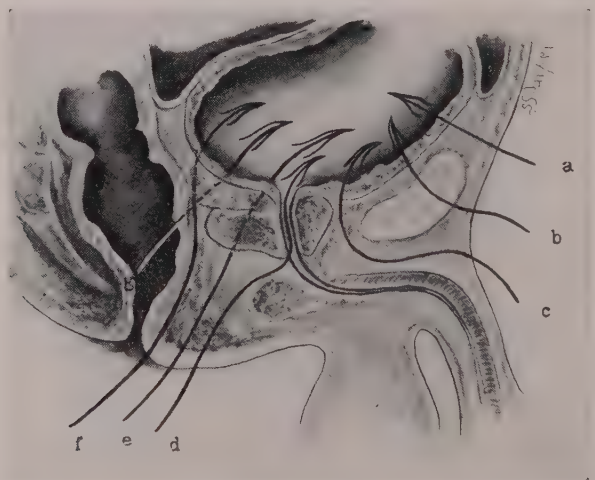


Fig. 4696.—Routes of Approach to the Male Bladder _ (other than through the urethra): _ **a,** Suprapubic; _ **b,** transsymphyseal; _ **c,** subpubic; _ **d,** perineo-urethral; _ **e,** transprostatic; _ **f,** rectal.

exposed, limitedly, in the median line, below the anterior reflection of the peritoneum (extraperitoneally) _ which amounts to more of an operation, but is the only way in which one can be absolutely positive of not entering the peritoneal cavity, and possibly wounding the intestines (v. Relations of the Peritoneum, p. 489).

Various routes to the bladder have been employed from time to time, and under various conditions. These, in the male, are the suprapubic, transsymphyseal, subpubic, perineo-urethral, transprostatic, and rectal (Fig. 4696). In the female they are the suprapubic, transsymphyseal, subpubic, vaginourethral, and vaginal (Fig. 4697).

The suprapubic puncture, under analgesia, is practically the only method of paracentesis now employed _ and will be here described (v. Figs. 4696 and 4697, **a**).

Preparation.—Ascertain that the bladder is well distended. Shave the region of the median line, just above the symphysis pubis. Analgesiate the suprapubic area.

Position.—Patient supine _ or sitting upright, supported. Surgeon on patient's right, facing him.



Fig. 4697.—Routes of Approach to the Female Bladder _ (other than through the urethra): _ a, Suprapubic; b, transsymphyseal; _ c, subpubic; _ d, vagino-urethral; _ e, vaginal.

Point of Puncture.—In median line, immediately above the upper border of the symphysis pubis.

Operation.—Having outlined the distended bladder by percussion _ a curved cannula and trocar (which are better than the straight) are taken in the



Fig. 4698.—Suprapubic Paracentesis of the Bladder; _ Trocar and cannula are shown piercing the abdominal wall just above the symphysis pubis, and entering the distended bladder, which has usually raised the peritoneal reflection above the danger of being penetrated. The empty bladder is seen in dotted outline, showing the danger, under such circumstances, of penetrating the peritoneum and wounding the intestines.

operator's right hand, with the convexity upward, and so held, with the index-finger upon the shaft of the instrument, that the depth to which it may enter the

bladder is fixed in advance. The bladder is steadied by the Surgeon's left thumb and index placed on each side of the median line. The instrument is thrust sharply but gently into the bladder, entering in the median line just above the symphysis pubis, and directed backward and downward (Fig. 4698) – piercing skin, superficial fascia, passing between the inner borders of the recti and pyramidales (or through their muscular substance), prevesical space, anterior bladder wall, and into the bladder. The trocar is then withdrawn and the cannula left *in situ* until the urine has come away, chiefly of its own accord, but partly aided by gentle pressure. Upon withdrawal of the instrument the opening is at once closed by sterilized cotton and collodion.

Comment.—Incision of skin may be first made and then trocar introduced. This may be done either to avoid the most difficult part of the puncture mechanically, namely, the penetration of the tough skin with a comparatively dull instrument, – or it may done, as above mentioned, for the purpose of first exposing the bladder before puncturing.

If the skin be drawn downward over the symphysis just before puncture a valve-like opening will be formed.

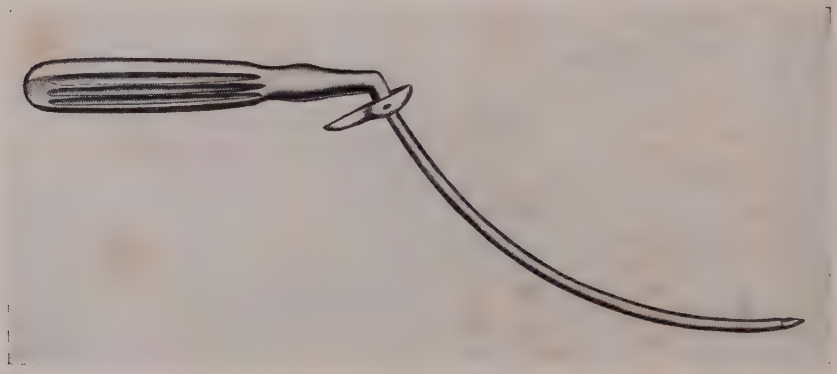


Fig. 4699.—Buck's Trocar for Puncture of the Bladder. (From Tuttle.)

In those rare cases in which the reflection of peritoneum comes very low down, to or behind the symphysis pubis, it will almost certainly be wounded – not being possible to avoid it, except, were it known in advance, by exposing the area by dissection and pushing the peritoneum upward before the puncture. Puncture of the peritoneum, however, is exceedingly rare provided the bladder be well distended, and a curved instrument be used.

A type of trocar and cannula formerly used in some of the unusual methods of puncture, such, for instance, as the rectal puncture, is shown in Fig. 4699.

Where temporary emergency drainage is indicted, the cannula may be left *in situ* for a limited time – or, better, a rubber catheter may be slipped through the cannula and the cannula be withdrawn.

The cannula, of the trocar and cannula used, should have a caliber of about a No. 20 French catheter.

The urine should be withdrawn very slowly, arresting the flow at intervals – to avoid congestion and hemorrhage of the mucosa from relieved pressure.

CYSTOTOMY, IN GENERAL

Description.—By cystotomy is meant the incision of the bladder. The bladder may be exposed and opened either extraperitoneally or transperit-

oneally, — the former being the method almost invariably adopted (except when the bladder is opened in the course of some intra-abdominal operation). The approach, when made extraperitonally, is either by the suprapubic or by the perineal route — usually the former.

Varieties of Cystotomy.—Cystotomy, therefore, may be either suprapubic, median perineal, lateral perineal, bilateral perineal, mediolateral perineal, vaginal, and by external urethrotomy. The suprapubic and median perineal are, in the male, practically all which are now performed — and, of these, the suprapubic much the more frequently. In the female the suprapubic operation is done most often — and, at times, the vaginal.

The perineal operations were, formerly, much resorted to for the removal of vesical calculi — and, from the standpoint of drainage alone (not weighing other considerations), were the operations of choice. At the present time the suprapubic operation is almost the only method of cystotomy practised — as preferable in the case of stones, especially large ones — and as affording the application of satisfactory modern methods of drainage. The chief application of perineal cystotomy at the present time is in connection with operations upon the prostate gland. Cystotomy for the removal of calculus should replace the incorrect expression, "lithotomy" (or "stone cutting," literally).

Indications for Cystotomy.—Calculi; foreign bodies in the bladder; exploration; drainage; access to prostate; intravesical tumors; diseased conditions of the vesical mucosa; intravesical catheterization of the ureters; some bladder wounds, and the like.

MEDIAN SUPRAPUBIC CYSTOTOMY

BY MEDIAN, EXTRAPERITONEAL ABDOMINAL INCISION—FOLLOWED BY MEDIAN DIVISION OF THE BLADDER

Description.—The bladder is exposed by a median incision just above the symphysis pubis — the approach, throughout, being extraperitoneal. When the bladder is reached through the prevesical space, its anterior wall is incised in the median line, below the peritoneal reflection.

The chief indications for suprapubic cystotomy, are the following: — vesical calculi, especially when large or encysted; exploration; foreign bodies; tumors; for access to the prostate gland; in some cases of cystitis; in some cases of vesical ulceration; and the like. It is the method of exposure usually resorted to in most of the surgical procedures directed within or upon the bladder.

Preparation.—It is often indicated by the condition calling for operation to make preliminary preparation for the special operation upon the bladder, such as intravesical irrigation with boric acid or other antiseptic solutions — and the taking of urotropin. The pubic region is shaved. At the time of operation the bladder should be finally irrigated, and left filled to its reasonable capacity — that is, with about 12 ounces of warm 2 per cent. boric acid solution. In the male the penis is sometimes lightly compressed by a rubber band, or the ligated catheter may be left anchored in the urethra, in male or female, to prevent the outflow of bladder fluid.

Position.—The patient is placed in a moderate Trendelenburg position (Fig. 4700). The Surgeon usually stands upon the patient's right, cutting from above downward — and the Assistant, opposite.

Landmarks.—Median line; upper border of the symphysis pubis. See relations of the anterior bladder wall, and peritoneal reflection, under Surgical Anatomy, p. 488.

Incision.—From 7.5 to 10 cm. (3–4 inches) in length — placed in the median

line and ending just above the symphysis pubis. The extreme upper and lower ends of this incision are not carried to the lowest depths of the wound – but are only superficial, to allow for retraction of the parts.

Operation.—The skin and superficial fascia are divided in the median line, at one cut. Any vessels which bleed are ligated. Sometimes abundant



Fig. 4700.—Patient in the Trendelenburg Position for Bladder Operations – I; – The median abdominal, suprapubic incision, for the exposure of the bladder.

fatty areolar tissue must be traversed. The interval between the inner borders of the recti and pyramidales is sought, but is frequently not demonstrated – and, if not, the muscle tissue is divided in the line of its fibers without further needless search – the edges of the wound being well retracted as they are deepened (Fig. 4701). The transversalis fascia is encountered and similarly divided in the median line – and the prevesical space reached. The areolar

tissue overlying the prevesical space is cautiously divided in the median line – extreme care being here used, for the purpose of recognizing the lower reflection of peritoneum, especially if it be prolonged unusually far down. The peritoneal fold must be sought from below (near the symphysis) upward, the dissection beginning immediately above the upper border of the symphysis. As soon as encountered the peritoneal fold is carefully pushed upward, with the left index, off the front of the bladder, so as to be out of the way of injury. All the prevesical fatty areolar tissue should be divided accurately in the middle line, until the bladder wall is well exposed – which is generally recognized



Fig. 4701.—Median Abdominal Suprapubic Cystotomy – II; – Following the division of the skin fascia, and aponeurosis, shown in Fig. 4700, the recti and pyramidales are being separated in the middle line by blunt dissection. Where the exact median line is not cut upon in the original incision, or recognized in the immediately following steps, the muscle-fibers are separated in their cleavage line as near the middle as possible.

by its pink muscular appearance, convex contour, fluctuation, and elasticity. The lips of the wound should be well retracted – and any bleeding from the prevesical veins controlled.

With the back of the knife toward the symphysis pubis a controlled stab cut is made just above the symphysis, into the cavity of the distended bladder (Fig. 4702) – and cuts its way upward, in the median line, in the act of withdrawal. Occasionally, for some special reason, the bladder wall may be incised transversely rather than vertically (v. Fig. 4702). Prior to incising the bladder some Surgeons steady its wall – either by non-traumatizingly

clamping its anterior wall to either side of the median incision to be made into it – or by two tenacula passed transversely across the median line, through the outer coats only, at the extreme upper and lower limits of its exposed surface, and held in the two hands of the Assistant – or by two tenacula placed parallel with the bladder incision to either side of it (Fig. 4703) – or two thread retractors may be placed through the outer walls, to either side of the proposed incision into the viscus. The object of these measures is twofold, – the bladder is steadied while the stab incision is being made – and the margins



Fig. 4702.—The Same – III; – The stab incision of entry through the coats of the bladder, in the median line. The transverse incision of the bladder is also indicated in dotted line. The symphysis pubis is seen below – and the unopened peritoneal reflection above.

of the cut are subsequently under control, both for drawing them upward, immediately following the incision of the bladder, and thus preventing the otherwise extensive outgushing of bladder fluid – as well as giving good control of the incision margins during subsequent manipulations.

When all, therefore, is in readiness the Operator, with sharp, narrow knife, by a quick, controlled thrust, stabs through the bladder wall, just above the symphysis – insuring, by this method, the penetration of all coats of the bladder – and not the protrusion of the mucous coats ahead of the knife cut, as sometimes happens in a slowly made incision. The length of

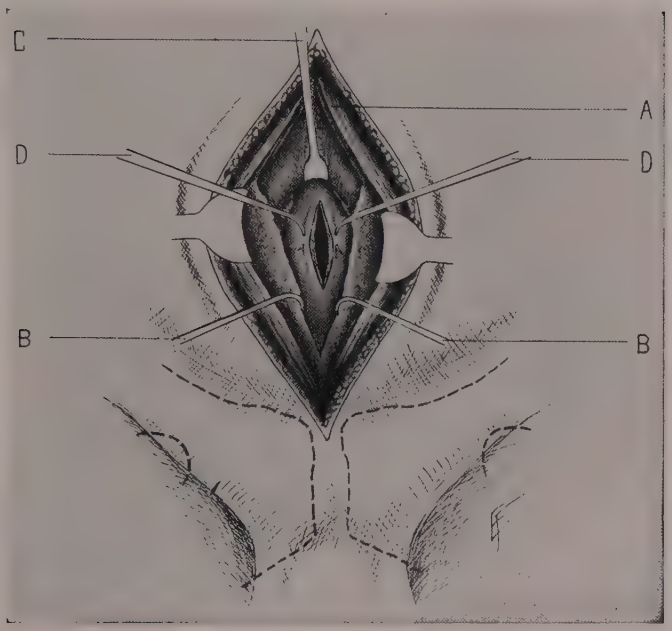


Fig. 4703.—The Same _ IV: _ A, Margins of recti and pyramidales muscles; _ B, B, prevesical areolar tissue freed and retracted from bladder; _ C, peritoneum retracted upward (unopened); _ D, D, tenacula passed through serosa and muscular coats of bladder, and subsequently used to retract lips of bladder wound.



Fig. 4704.—The Same _ V; _ The bladder is first incised to a limited extent for the purpose of exploration _ during which the margins of the bladder wound may be held apart by looped suture retractors, a, a, or by small metal retractors, or by non-traumatizing clamps; _ b, b, median margins of abdominal muscles; _ c, symphysis pubis; _ d, unopened peritoneum retracted.

the bladder wound is increased to the desired extent in the act of withdrawing the knife. The contained fluid immediately escapes from the bladder – but, owing to the holding up of the bladder by whatever means may have been used, but a small amount enters the prevesical wound.

Two silk traction sutures (unless they have already been placed, or clamps have been used) are now carried through the center of each lip of the bladder wound (Fig. 4704). If steadying tenacula have been employed, they are withdrawn. If no method for steadying the bladder during its incision have

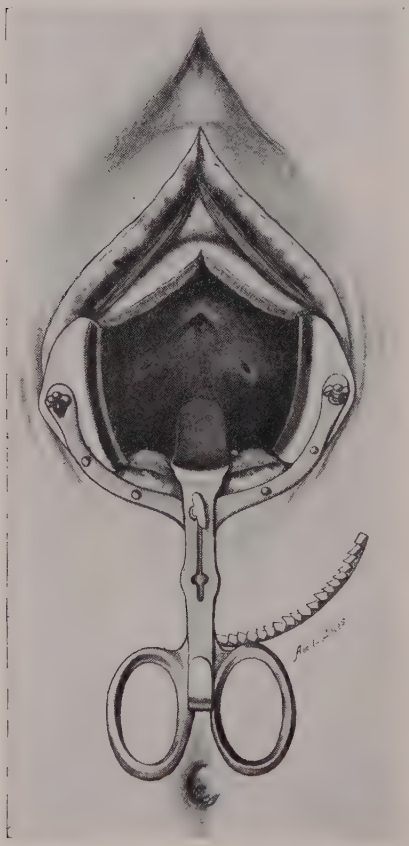


Fig. 4705.—The Same – VI; – The bladder cavity fully exposed by an automatic, tribladed retractor.

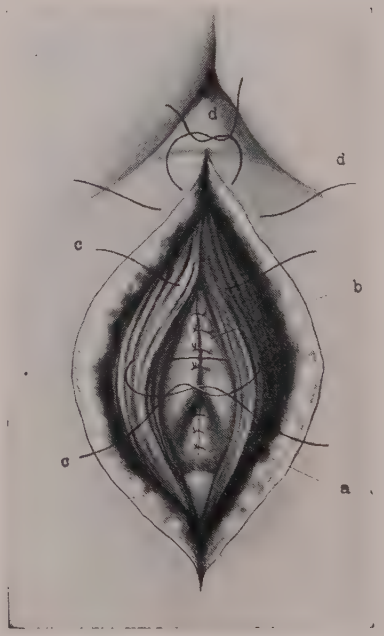


Fig. 4706.—The Same – VII; – Closure of the bladder and abdomen, without drainage: – a, First, tier of non-penetrating catgut sutures, closing the margins of the bladder wound; b, second tier Lembert sutures reinforcing the line of incision; – c, interrupted buried, catgut sutures of the muscles; – d, interrupted silkworm sutures of the skin and connective tissue.

been used, the Surgeon, immediately following the bladder cut, thrusts a finger within the wound, before the bladder collapses, and at once introduces two bladder retractors, or some special form of self-retaining bladder retractor, by means of which the bladder is held both open and within reach during the rest of the operation (Fig. 4705). Hemorrhage may occur from the edges of the bladder incision at first, but is generally easily controlled. If the penis has been ligated, or a catheter has been retained, these are now removed.

If the original opening into the bladder be too limited, it is enlarged to the desired extent in the median line, upward or downward, or in both direc-

tions _ carefully guarding the peritoneum above, which especially tends to prolapse when the bladder is empty.

The interior of the bladder is carefully examined, both digitally and by illumination (either directed into the bladder from without or by intravesical light). Whatever may have been the object of exposing the bladder, or whatever may be indicated after opening the organ, is now accomplished _ upon the completion of which the question of closure or drainage will arise.

Where indicated _ in healthy condition of the parts and where no great traumatism has been done _ the bladder wound may be closed at once. In suturing, retract the upper and lower angles of the bladder wound by wound-hooks, thus approximating and paralleling the margins of the vesical wound.

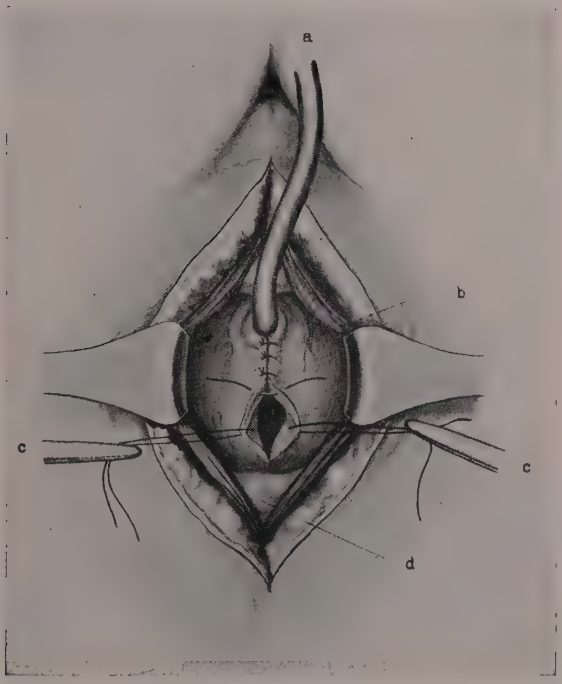


Fig. 4707.—The Same _ VIII; _ Establishment of bladder drainage: _ **a,** Drainage-tube, in lower angle of wound; _ **b,** first tier of interrupted, non-penetrating sutures, uniting the margins of the bladder; _ **c, c,** clamped suture retractors, introduced in Fig. 4704, may aid during the suturing, but are withdrawn at the end of the suturing _ otherwise non-traumatizing forceps or clamps are employed in steadying the edges of the bladder incision during the placing of the stitches; _ **d,** unopened peritoneum.

Withdraw the silk traction sutures, if used, as soon as the wound-hooks are in place. The margins of the bladder are then neatly and closely brought together with fine chromic gut upon a curved needle _ placed interruptedly and passing through all the coats except the mucous membrane (Fig. 4706, **a**). It is well to reinforce this line of suturing with a second tier of interrupted Lemberts of silk or fine gut _ the roughened connective-tissue coat of the bladder, being approximated in the Lembert fashion, uniting (Fig. 4706, **b**).

The superficial wound is now closed _ except to a small extent immediately over the center of the bladder wound _ where temporary drainage is established for thirty-six or forty-eight hours in case of leakage. Two tiers of sutures are used in the superficial wound _ a buried chromic gut interrupted or con-

tinuous tier, uniting the divided muscle tissue (Fig. 4706, **c, c**) – and a superficial silkworm-gut, or silk, placed interruptedly through the skin and fascia (Fig. 4706, **d, d**).

In those cases in which drainage may be indicated, for shorter or longer time, this is usually accomplished by rubber tubing in a simple manner – though some of the special forms of bladder drains are quite elaborate (v. Cystostomy, p. 554). In employing a simple form of rubber tube the bladder is first closed by the already described first tier of non-penetrating sutures, up to the exit of the drain from the lower angle of the wound (Fig. 4707, **a** and **b**). The second tier of Lembert sutures is also placed in the manner just described – and, like the first, is carried up to the exit of the tube (Fig. 4708). The muscles and skin are also sutured up to the drain. Finally the tube is safely anchored

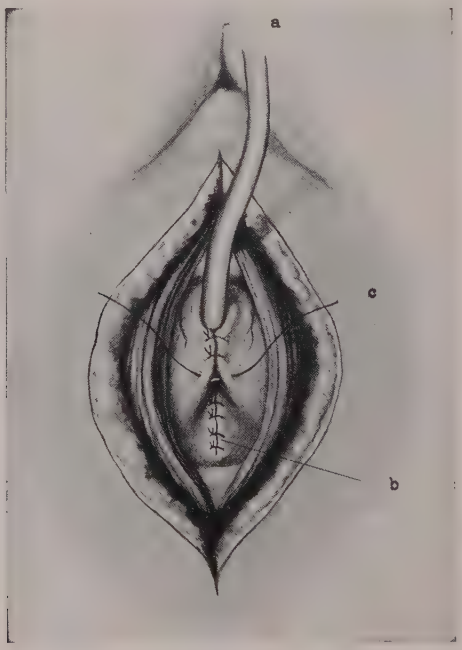


Fig. 4708.—The Same – IX: – **a**, The bladder opening has been closed around the drainage-tube by non-penetrating sutures of its margins, **b**, after which the first tier of marginal suturing is buried in by a second tier of Lembert sutures, **c**.

in the wound, so that by no mishap may it come out, as its reintroduction might be most difficult or impossible without opening the wound.

Comments.—Sometimes the bladder is distended with air instead of water.

Formerly it was frequently the custom (which sometimes now is carried out) to begin the operation by placing a collapsed rubber bag in the emptied rectum – which was then filled with 10 or 12 ounces of water (or with air) – after which the bladder was irrigated, and then filled with 8 to 10 ounces of water. The result of first distending the rectum and then distending the bladder afterward is to displace the bladder upward in the pelvis, and thereby elevate the peritoneal reflection and present a greater extent of anteror vesical wall uncovered by peritoneum. This technic is shown in Fig. 4709.

Unusual rigidity of the abdominal muscles, even under anesthesia, some-

times makes it difficult to get sufficient retraction of their lateral borders to satisfactorily expose the bladder _ in which cases the margins of one or of both recti may be limitedly incised in an oblique direction (to be subsequently repaired by mattress-suture) _ as shown in Fig. 4710 _ remembering, however, that such division does not leave as strong an abdominal wall against hernia as suturing following a simple median incision.

The recognition of the superoposterior border of the symphysis pubis by the finger, early in the operation, is a valuable rallying point in locating the distended bladder just posterior to it.

After exposing the symphysis pubis the transversalis fascia is incised medially and the prevesical fat encountered. It is more surgical to incise this, but if there seem danger of wounding the peritoneal reflection, it may be more

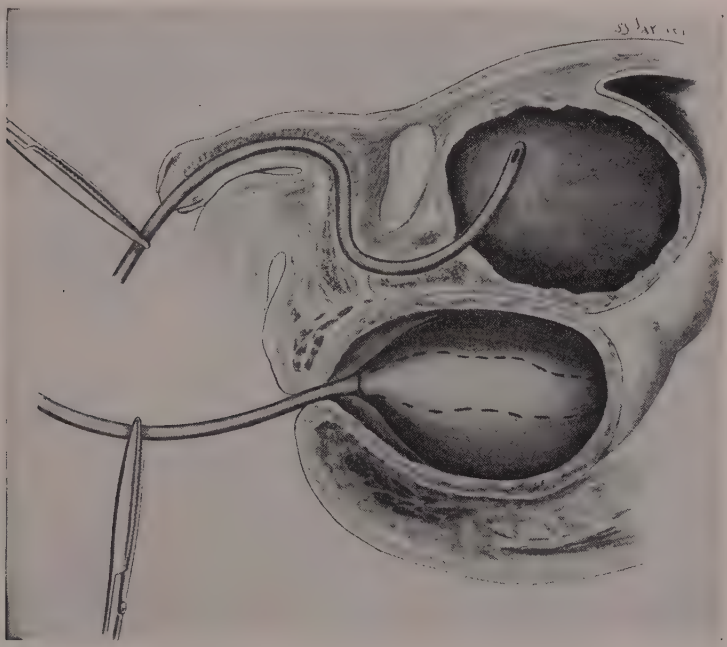


Fig. 4709.—Distention of the Bladder with Fluid Preceded by Distention of the Previously Placed Rectal Bag _ Petersen; _ Note the resulting elevation of the peritoneal fold and increase of the free suprapubic space. The position of the rubber bag when collapsed is shown in dotted outline.

safely torn through by blunt dissection. When once isolated the peritoneal fold should be displaced well upward.

The bladder is recognized by its muscle-fibers, pinkish color, and by the veins traversing its surface parallel with the midaxis of the body.

The peritoneal pouch, if otherwise not recognizable, may sometimes be detected through its distention by a coil of intestine entering it during the descent of the diaphragm.

Where the presence of the bladder is questionable, a fine aspiratory needle may be introduced to withdraw corroboratory fluid _ provided there be no alternative of puncturing a coil of intestine.

Another method of bringing the anterior wall of the bladder into the wound in difficult cases _ and provided an instrument may be passed through the urethra, after allowing the distending fluid to escape from the bladder _

is through the use of a sound, introduced and manipulated as shown in Fig 4711.

The technic of bladder distention mentioned by Walker is especially good. After throwing the 10 to 12 ounces of warm boric acid solution (at 108° F.) into the bladder, through a catheter, by means of a syringe, the syringe is finally reloaded, while the catheter is pinched, and the tip of the syringe is then made to plug the end of the catheter. The syringe rests upon a towel stretched between the thighs, and when more bladder distention is required during the course of the operation, the contents of the syringe are readily added to the amount already in the bladder. Further, if an easy-running



Fig. 4710.—Temporary Partial Division of the Recti in Cystotomy;—Where more room for manipulation is required, in a lateral direction, the recti may, if absolutely necessary, be temporarily divided, transversely, or obliquely, on one or both sides, in their lower part—to be sutured at the end of the operation.

syringe be employed, intravesical tension would be indicated by the spontaneous outward movement of the piston of the syringe.

If the bladder cannot be previously distended (as in the presence of a vesical fistula), and if a sound cannot be passed, so that the bladder must be opened in a collapsed condition, without any form of guide, the difficulty may be considerable. Under such circumstances one must proceed carefully, on anatomic grounds, aided by good artificial illumination. If neither water nor sound can be introduced, the bladder may be somewhat elevated by the use of the rectal bag alone.

The aspect of the bladder which is incised is that which lies in contact with the abdominal wall rather than the portion behind the symphysis pubis.

In all cases where the bladder is closed by suture, without drainage, a catheter is invariably anchored in the urethra during the solidification of the bladder stitches, so that distention of the bladder by urine may not jeopardize the suturing.

The first non-penetrating tier of sutures pierce the muscular and submucous coats as ordinary interrupted or continous sutures – and the second tier is of the Lembert type, and pass through the muscular coat, the connective tissue covering of the bladder uniting as the serosæ of the intestines do.

Avoid detaching the anterior bladder wall from the posterior surface of the symphysis pubis.

If the peritoneum be accidentally wounded, immediately close it with fine catgut sutures of the Lembert type.

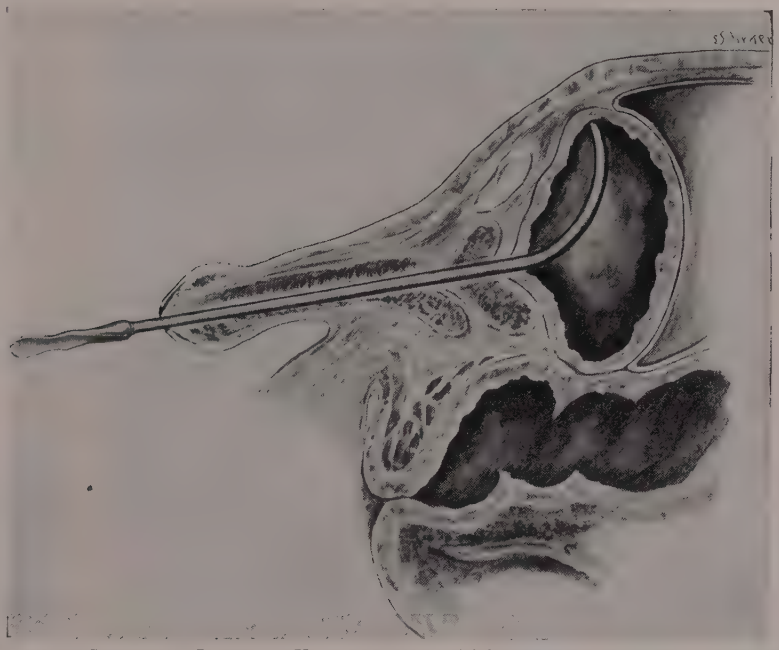


Fig. 4711.—Suprapubic Cystotomy Upon a Sound – which has been introduced through the urethra and made to bulge the bladder prominently forward, between the symphysis pubis and the peritoneum – Von Dittel's technic.

Use round needles in suturing the bladder – the holes from which are less apt to leak than are those made by a cutting needle.

In those cases where the bladder wound is left open for drainage the edges of the incised bladder are often stitched, with fine chromic catgut, into the deeper margins of the suprapubic wound of exposure.

In children the bladder is, naturally, higher in the abdomen.

The question of drainage, upon the completion of cystotomy, amounts to this, as a general proposition: – bladders which are distinctly infected should be drained suprapubically – while clean bladders or almost clean bladders should not be suprapubically drained. All bladders should be temporarily drained by the urethra, to take all possible strain off the bladder sutures. Even where the bladder is closed, the abdominal wall wound should be temporarily drained down to the sutured bladder.

Further considerations of drainage will be found under Cystostomy, p. 554.

After-treatment.—In the after-treatment of cystotomy cases Caulk lays stress upon the importance of keeping the urine acid _ alkaline urine interfering with satisfactory healing, and favoring phosphatic deposit. For the purpose of acidifying the urine by his technic Bulgaric bacilli are introduced into the bladder upon the completion of the operation _ and are maintained there, as determined by examination, during the period of convalescence.

The average time usually spent in bed following cystotomy is from ten to fourteen days _ for the solidification of the wound alone _ and in connection with drainage _ or longer, on account of the latter.

TRANSVERSE SUPRAPUBIC CYSTOTOMY

BY PFANNENSTIEL'S TRANSVERSELY CURVED SUPRAPUBIC ABDOMINAL INCISION —FOLLOWED BY TRANSVERSE DIVISION OF THE BLADDER

Description.—In the ordinary Pfannenstiel division of the abdominal wall the curved, transverse incision only passes through the skin and fascia _ after which the recti and pyramidales are separated along the line of their median contact (v. Vol. IV, p. 131). In the present technic not only are the skin and fascia divided by a transversely curved incision, but the abdominal aponeuroses and muscles are divided by a straight transverse incision _ and, finally, the bladder itself is opened by a transverse incision.

This exposure and opening of the bladder is usually employed where only the freest access is required _ especially in extensive and difficult tumor involvements requiring the excision of part or all of the bladder. As against the advantages of approach, however, must be weighed the damage apt to result from transverse division of the abdominal wall.

Preparation _ Position _ Landmarks.—As for median suprapubic cystotomy (v. p. 525).

Incision.—The incision, as well as the early steps of the operation, follow the usual technic of abdominal section by the Pfannenstiel incision (Vol. IV, p. 131). The curved incision about 15 to 20 cm. (6–8 inches) in length, made over the distended bladder, has a downward convexity which reaches to within about 2.5 cm. (1 inch) of the symphysis pubis _ while its ends are about 5 cm. (2 inches) above Poupart's ligament _ the patient being in the Trendelenburg position and the bladder distended with fluid.

Operation.—The curved incision is everywhere carried through skin and fascia to the abdominal aponeuroses. After its natural retraction along the line of incision, the curved flap is freed up, toward the umbilicus, to a limited extent _ so that skin section and muscle section will not actually coincide. At this slightly higher level the aponeuroses of the recti, the recti themselves, and the pyramidales are all divided transversely (Fig. 4712). This transverse division must be made carefully _ as the peritoneum is nowhere cut. If the muscular structures are divided entirely across at a stroke, their ends would retract to such an extent that their subsequent approximation would be difficult _ so that prior to completing the transverse division of the recti it is well to place at least one stout mattress stitch on each side _ while guarding the under aspect of the muscles by a finger during the passage of the needle _ and then loosely knot the suture ends, so as to be able to control the divided muscle ends. It is the passage of these sutures through the sheath of the recti which keeps them from tearing out when they are tied later on.

Beneath the recti and pyramidales the transversalis fascia is divided in a correspondingly transverse line _ which brings one down to the peritoneum. The peritoneum is carefully recognized, at its reflection to the dome and

sides of the bladder, and not cut – but retracted upward from the antero-superior aspect of the bladder.

The exposed bladder is now ready for incision – the encroaching structures being well retracted – and provision being made to catch the escaping fluid. The anterior bladder wall is then transversely incised on, approximately, the upper level of the pubic arch, where its transverse width is greater than higher up. As soon as the incision is made the margins of the incised bladder are seized with non-traumatizing clamp forceps, so as to control them in further manipulations – and the outgushing fluid, which is less the higher the walls of the bladder are held, is caught in some receptacle.

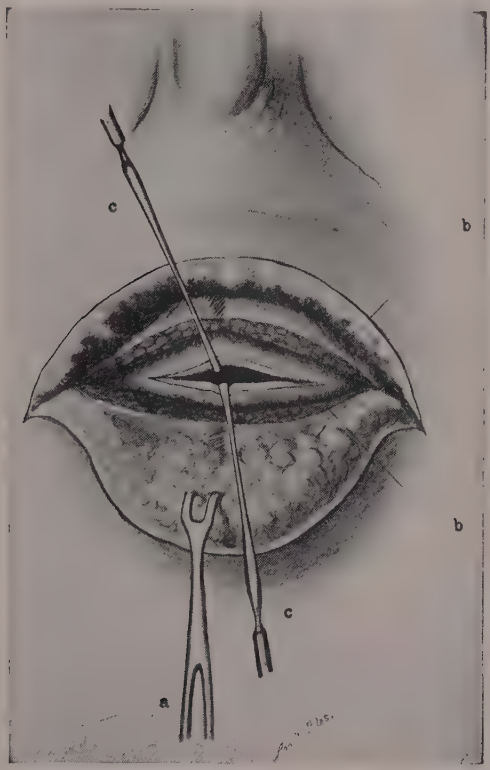


Fig. 4712.—Transverse Suprapubic Cystotomy – I: – a, Retraction of the skin-flap raised by the Pfannenstiel incision; – b, b, transverse incision of the recti; – c, c, retraction of the margins of the transversely incised bladder.

Having accomplished the object for which the bladder was exposed and opened, the margins of the bladder opening are brought together in the manner elected usually by a preliminary row of non-penetrating stitches, followed by a row of Lemberts, passing into the muscular but not through the mucous coat – or by a first row of non-penetrating sutures, followed by a second row of simple interrupted sutures of the outer coats.

The abdominal musculature must be brought together with especial care, owing to the tendency of tranverse incisions to involve future trouble. The most resistant structure must be utilized, which is the aponeurotic sheath of the rectus – and the best method of suturing is by means of stout mattress-sutures of chromic catgut, silk, or linen. Or some of the sutures may be of

the mattress type, and some of the ordinary interrupted type – as shown in Fig. 4713. Finally, if the fascia be thick, this may be brought together separately by a tier of buried catgut sutures – after which the skin is closed with silkworn filament.

It is safer to carry a temporary drain down to the sutured bladder, through the outer abdominal wound and to relieve the bladder sutures from strain by a retained catheter.

Comments.—In providing bladder drainage it is probably better to entirely close the transverse bladder wound, and then institute tubal drainage through an adjacent part of the bladder wall by a stab incision.

It is also well to install a temporary drain of the prevesical space.

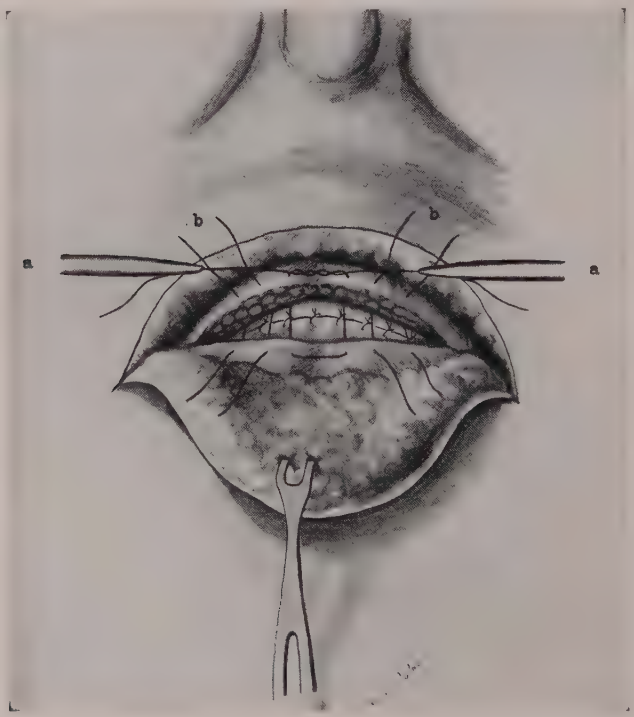


Fig. 4713.—The Same – II; – Non-penetrating sutures are shown closing the bladder wound, – and, a, a, mattress-sutures and b, b, interrupted sutures are uniting the transversely divided abdominal muscles and aponeuroses (the former being preferable in transverse divisions).

If infection occurs in the transverse operation, it is more difficult to deal with than in the median operation.

The nature of the operation for which the transverse technic was adopted will largely determine the final details of wound treatment.

Other Combinations of Technic in Suprapubic Cystotomy.—In addition to the two more usual types of suprapubic cystotomy above mentioned, the following variations of technic may be also adopted:

(*a*) Transverse Suprapubic Cystotomy, following Median Division of the Abdominal Wall, by the Extraperitoneal Route.

(*b*) Median Suprapubic Cystotomy, following exposure of the Bladder by Pfannenstiel's Transversely Curved Suprapubic Abdominal Incision.

It will be noticed that these are the reversals of the two operations described at length, just preceding.

INTERPUBIC CYSTOTOMY

FOLLOWING SYMPHYSIOTOMY—ALBARRAN

Description.—This procedure consists in the temporary displacement of the penis at its pubic attachment, and the temporary separation of the pubic bones at their symphyseal union _ after which the anterior wall of the bladder is exposed and incised. The operation has been performed a few times _ where access to the lower, anterior wall of the bladder is required _ but is a much more considerable undertaking, for Surgeon and Patient, than



Fig. 4714.—Interpubic Cystotomy _ Albarran _ I; _ Line of inverted Y-shaped incision.

the methods just described _ and is considered, by Albarran, indicated only rarely.

The Author has no knowledge of a recorded case of its performance upon the female _ although its performance in that sex would appear easier of execution.

Preparation _ Position _ Landmarks.—As in suprapubic median cystotomy (v. p. 525).

Incision.—An inverted Y-shaped incision of approach is made (Fig. 4714). It begins as a median vertical cut at a point about three finger-breadths above the symphysis pubis _ passes down to a point 1 cm. (6/16 inch) above the dorsum of the root of the penis, where the single incision divides into two limbs which, in turn, pass obliquely over the lateral aspects of the dorsum of the penis for the extent of about 2 cm. (13/16 inch).

Operation.—With the bladder irrigated and filled with air, the above incision is carried through skin and fascia – down to the sheath of the recti and to the suspensory ligament of the penis. The suspensory ligament of the penis is divided (Fig. 4715, **a**) – and the body of the penis is temporarily displaced downward – thus giving approach to the inferior aspect of the symphysis pubis. All of the tissues are divided over the symphysis pubis down to the bone. The inner borders of the recti and pyramidales are exposed



Fig. 4715.—The Same – II; – The dotted, inverted Y-shaped line shows the skin incisions through which the deeper exposure is made: – **a,** Temporary severing of the suspensory ligament of the penis from the symphysis pubis; – **b,** grooved director passed behind the symphysis pubis, upon which the interarticular cartilage is divided. (Figs. 4714–4716 modified from Albarran.)

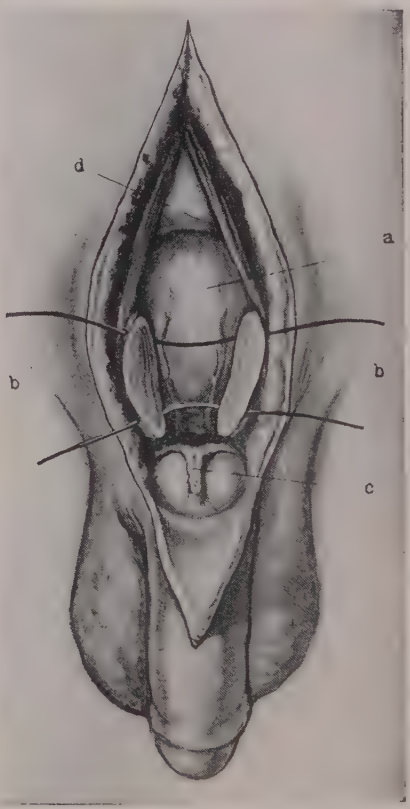


Fig. 4716.—The Same – III: – **a,** The bladder exposed between the separated pubes ready to be incised; – **b, b,** separated pubes, drilled, with silver wire, or kangaroo tendon inserted, ready to be tied; – **c,** incised suspensory ligament of the penis, to be repaired by suture; – **d,** peritoneum, unopened.

and separated just above the upper border of the symphysis pubis by blunt dissection – for the purpose of gaining access to the posterior aspect of the symphysis, as well as the anterior surface of the bladder, through the space of Retzius.

Recognizing the peritoneal reflection and displacing it upward, a spatula or other flat or slightly curved instrument is passed through the space of Retzius, hugging the posterior aspect of the symphysis pubis, – the penis

being further drawn down by a retractor, which, at the same time, protects the structures beneath the pubic arch _ and while the neighboring structures are thus protected, the symphysis pubis is divided, exactly in the median line, by means of a stout knife _ (or, if this be difficult, a Gigli saw may be conducted behind the bone, and be made to cut its way forward). If the section be made with a knife, the cut passes from above downward, and from before backward, through the interarticular cartilage. The subpubic ligament is then divided very carefully to avoid wounding the plexus of Santorini and the deep dorsal vein of the penis. The division of the symphysis is sometimes made with bone-cutting pliers.

After assurance, digitally, that the bony union is completely divided, the surfaces of the cut pubic bones may be separated laterally to the extent of from 4 to $4\frac{1}{2}$ cm. ($1\frac{9}{16}$–$1\frac{12}{16}$ inches) without endangering the sacro-iliac joints.

Having accomplished the special operation upon the bladder for which the exposure was made, steps to re-unite the ends of the pubic bones are undertaken. The symphyseal cartilage is excised from the ends of the pubic bones, so as to expose fresh spongy bone tissue for better bony union. Then, where the separation of the bones had only been moderate, Albarran advised the suturing together of only the surrounding soft parts overlying the divided ends of the bones. But where the separation has been considerable, he advised uniting the bone ends with two sutures of silver wire, conducted through drilled holes in the pubic bones, near their margins (Fig. 4716).

Temporary drainage of the postpubic space is instituted by placing a drainage-tube behind the symphysis pubis, bringing it out over the top of the symphysis. The integrity of the suspensory ligament of the penis is restored by chromic gut sutures. The margins of the abdominal wound are brought together in the usual manner _ and the skin margins along the inverted Y-shaped incision are united.

Finally, a firm binder is applied around the pelvis to reinforce the weakened pubic joint during healing.

TRANSPUBIC CYSTOTOMY

FOLLOWING OSTEOPLASTIC RESECTION OF THE PUBIC ARCH

Description.—The upper border of the pubic arch and the upper aspect of the anterior surface of the symphysis pubis and laterally adjacent portions of the pubic bones are raised as an osteoplastic flap, with the recti and pyramidales still adherent, and temporarily turned upward _ exposing the anterior aspect of the bladder _ which is then incised. At the end of the operation the composite flap is returned to its position and sutured into place.

This, like the preceding operation, is sometimes resorted to in cases where it is desired to expose the lower part of the anterior wall of the bladder.

Preparation _ Position _ Landmarks.—As in suprapubic cystotomy by median incision (v. p. 525).

Skin Incision.—The features of the Pfannenstiel exposure are carried out, as the first step of the operation (Vol. IV, p. 131, where the method has been described). In the present instance the transversely curved incision, with downward convexity, is placed somewhat lower _ the convexity coming down upon the upper part of the symphysis pubis. And from the middle of the lower part of the convexity a straight incision is prolonged over the suspensory ligament and root of the penis.

Operation.—The above incisions are carried through the skin and connective tissue. The anterior surface of the symphysis pubis and the lower

ends of the recti muscles are exposed in retracting the curved flap, represented by the curved portion of the incision. The lateral aspects of the incision, including the vertical portion extending downward from the lower border of the curve, are retracted well to either side, exposing a considerable portion of the symphysis pubis and adjacent parts of the pubic bones. The suspensory ligament of the penis is partly divided temporarily. By means of a motor saw, or by chisel and mallet, the pubic bones are divided obliquely, from above downward and inward, beginning at the upper border, outside of the spines of the pubes, beyond the insertions of the recti – and then transversely across at the lower limit of the two lateral oblique sections. The

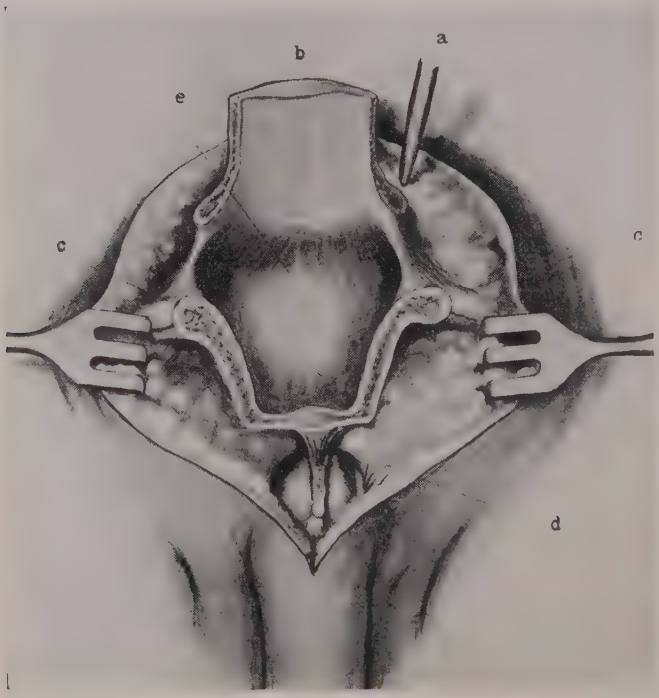


Fig. 4717.—Transpubic Cystotomy Following Osteoplastic Resection of the Symphysis Pubis – I; – Raising the flap: a, Pfannenstiel flap displaced upward; – b, bone-flap turned back; – c, c, bone sections of the pubes; – d, incised suspensory ligament of the penis; – e, bladder. (Figs. 4717 and 4718 modified from Watson and Cunningham.)

four-sided piece of bone, with the attachments of the recti undisturbed, is then turned upward, hinging upon the recti (Fig. 4717).

The prevesical space is thus exposed – and the anterior wall of the bladder. Bleeding from the venous plexus of Santorini is guarded against by careful manipulation. The bladder is incised – and the object of the operation accomplished.

At the end of the operation the composite flap is turned down into position after the margins are drilled – and the parts held together by kangaroo-tendon sutures or by silver wire (Fig. 4718). Temporary drainage of the prevesical space is secured by one or by two rubber tubes emerging just above the pubic arch, and conducted out of the line of suture, or through stab incisions. The suspensory ligament of the penis is restored by careful suturing. The aponeu-

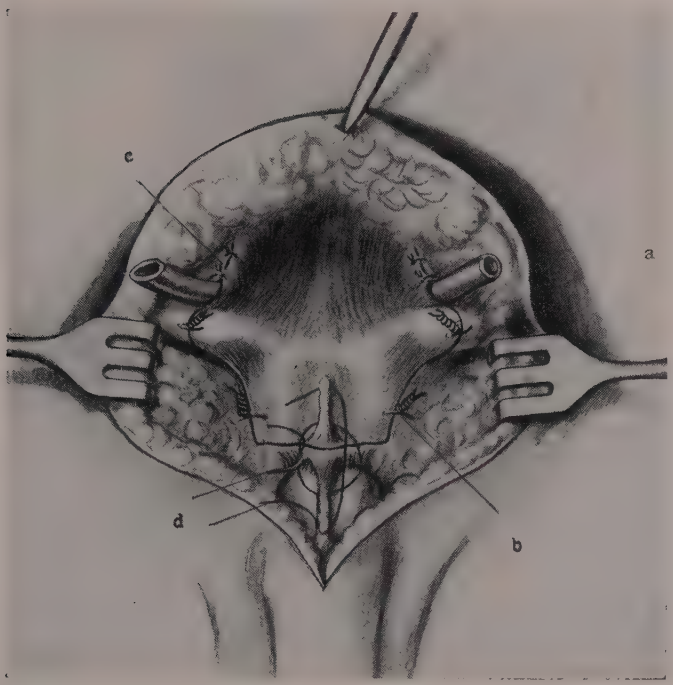


Fig. 4718.—The Same _ II; _ Suturing the flap: **a,** Wire or kangaroo-tendon sutures of the drilled bone; _ **c,** sutures of the aponeuroses; _ **d,** sutures of the suspensory ligament of the penis ready to be tied.

roses are sutured wherever divided. The margins of the skin incisions are brought together with silkworm filament.

VAGINAL CYSTOTOMY

Description.—In this procedure the floor of the bladder is incised through the anterior vaginal wall by axially cutting through the middle of the vesicovaginal partition behind the vesical orifice of the urethra. This is the simplest of all forms of cystotomy _ and is usually resorted to for bladder drainage in bad cases of cystitis and sometimes for the extraction of calculi. In operating upon the bladder through the vagina it is to be remembered that in addition to the possibilities of infection common to all exposures of the bladder cavity there is the additional danger of infection through the vaginal route.

Preparation.—As in the median suprapubic operation (v. p. 525).

Position.—Either upon the back, with elevated buttocks and flexed thighs, or in the knee-chest posture, according to the technic to be adopted (v. i.).

Landmarks.—The vesicovaginal wall, between the vesico-uterine attachment and the vesical orifice of the urethra _ which may be determined by a sound introduced into the bladder.

Vaginal Cystotomy in the Dorsal Position.—The patient lies upon her back, with thighs flexed, or legs in stirrups, and with the buttocks elevated and projecting beyond the end of the table. A Sims speculum retracts the posterior vaginal wall _ and smaller retractors may draw backward and outward the lateral vaginal walls. The base of the bladder, posterior to the

vesical end of the urethra, may be conveniently brought into the field for incision in one of two ways:

(*a*) A grooved staff, with the groove upon the convexity of the staff, is passed through the urethra and into the bladder (Fig. 4719), after which the straight portion of the staff is pushed toward the abdominal wall, causing the convex curve of the staff to round out, in a prominently forward fashion, the vesicovaginal septum – and, upon the groove of the staff, the vesicovaginal partition is incised to the desired extent (Fig. 4720).

(*b*) A pair of closed, curved artery clamps, or other special type of long, slender, curved forceps is passed into the bladder through the urethra – and

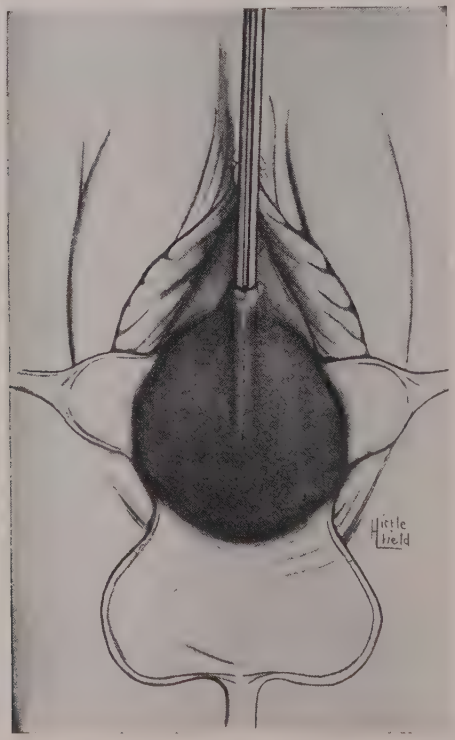


Fig. 4719.—Median Vaginal Cystototomy Upon a Curved Grooved Staff – the median line to be incised is shown dotted – upon the distended, prominently brought forward bladder.

so turned that its concavity will be directed forward and its point will prominently press the vesicovaginal wall forward. The blades of the instrument are then slightly separated, and the vesicovaginal partition incised between the separated tips of the forceps (Fig. 4721).

Vaginal Cystotomy in the Knee-chest Position.—With the patient in the knee-breast position, and the bladder filled with air, as occurs with the urethral speculum in position – the posterior vaginal wall being retracted by a Sims speculum – it is an easy and rapid technic to incise the vesicovaginal speculum with an angular knife – while the site of incision is being directly observed both through the urethral speculum and through the vagina – as shown in Fig. 4722.

In whichever of the above methods the vesicovaginal septum may be brought prominently forward into the field, the rest of the technic is the same in both cases. The bladder is usually previously distended with boric acid solution unless the open-air urethral speculum be used—although part of this must escape if the urethra be dilated. The incision through the vesicovaginal septum should be about 2 cm. ($\frac{3}{4}$ inch) in length. It is best made with a knife—but may be also made with very sharply pointed scissors. The cut is made in a backward direction—from behind the bladder orifice of the urethra, in the direction of the vesico-uterine attachment, as a clean cut



Fig. 4720.—Colpocystotomy Upon a Grooved Staff;—A grooved sound has been introduced into the bladder, upon whose convexity the vesicovaginal wall is bulged forward. An incision through this wall is then made directly down upon the groove, as shown.



Fig. 4721.—Median Vaginal Cystotomy Between the Blades of Forceps Opened Intraurethrally—performed between the separated blades of curved forceps introduced through the meatus.

through all the layers of the septum. The opening must be large enough for free drainage of the bladder in the class of bad cases in which the method is adopted.

In order to prevent the too rapid closure of the vaginal fistula the vesical mucosa and the vaginal mucosa are sutured together with a few interrupted fine catgut sutures. It is generally necessary to maintain drainage from a few weeks to several months. If the vesicovaginal drainage fistula does not eventually close of its own accord, it will become necessary to operate upon it in the same manner as for a pathologic fistula.

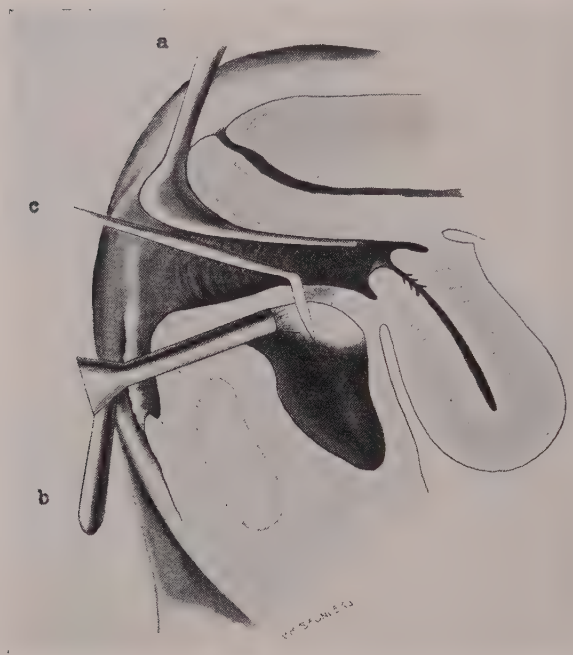


Fig. 4722.—Vaginocystotomy in the Knee-chest Position: _ a, Vaginal retractor exposing the posterior vaginal wall; _ b, bladder speculum directed toward the site of the bladder wall where the incision is being made; _ c, oblique, angular knife (Simon's) incising its way from the vagina into the bladder, through the vaginocystic wall, guided by the ocular exposure of the field.

LATERAL PERINEAL CYSTOTOMY

Description.—Incision of the bladder through the left lateral region of the perineum _ generally performed for the removal of calculi. The operation is sometimes incorrectly called Lateral Lithotomy. It is always performed upon the left side because the manipulations upon that side are more convenient to the Surgeon. The operation, as here carried out, is applicable to any purpose for which it is indicted to approach and open the bladder by this route _ but it is generally done for stone, although less frequently now than formerly. Calculi of moderate, but not the largest, size may be removed by this route. The special instruments required are: _ a left dorsolaterally grooved lithotomy staff; probe-pointed knife (if preferred to straight pointed); stout bistoury with cutting edge of about 5 cm. (2 inches); Clover's crutch, or some provision for maintaining the lithotomy position; wristlets and anklets may be used.

Preparation.—Rectum empty and irrigated. Perineum shaved. Recognition of calculus by sound.

Position.—Patient rests upon back, and, in this position, is brought down to end of table, so that buttocks come well over the edge of the table. While steadied in this position the special staff is passed into the bladder and given into the charge of an Assistant, who henceforth holds it steadily and unvaryingly in the middle line. Clover's crutch (and anklets and wristlets, if desired) are then adjusted, and the thighs flexed back upon the abdomen _ or an Assistant on each side may hold a limb in the above position without the use of the crutch _ and the patient remains in the characteristic lithotomy position

throughout the operation. The Surgeon sits at the end of the table facing the patient's perineum. The Assistant, standing on the left, who holds the staff in his right hand, holds up the penis and scrotum with his left. Up to the en-

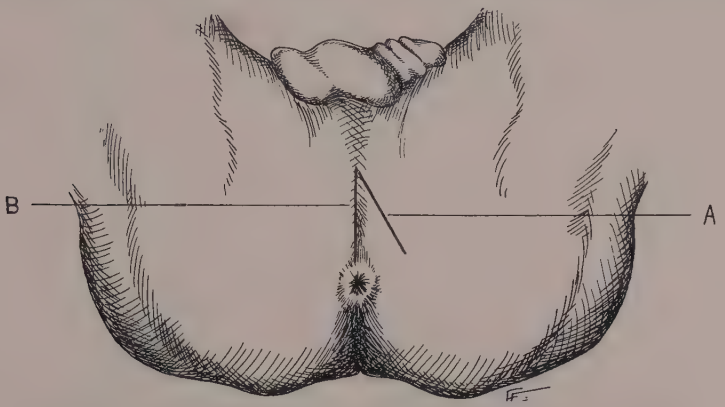


Fig. 4723.—Incisions for Perineal Cystotomy: – A, Lateral perineal cystotomy; – B, median perineal cystotomy.

trance of the knife into the groove of the staff, the staff is held so that its handle is nearly parallel with the abdominal wall, so that its convexity causes the membranous urethra to round out more prominently and nearer to the peri-

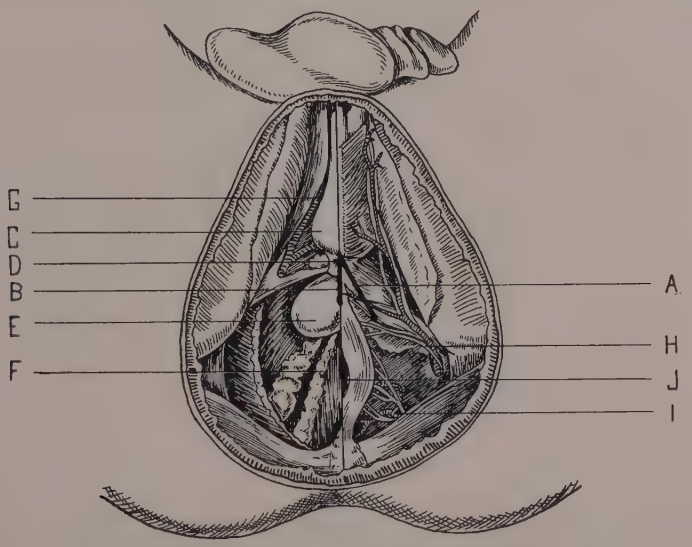


Fig. 4724.—Surface View of Perineum and Ischiorectal Regions; – Superficial structures are seen on right and deep on left: A, Incision for lateral perineal cystotomy; – B, incision for median perineal cystotomy; – C, bulb; – D, membranous urethra; – E, prostate gland; – F, vas deferens, vesicula seminalis, and base of bladder; – G, internal pudic artery; – H, superficial perineal vessels and nerves; – I, hemorrhoidal vessels and nerves; – J, anus. (Modified from Gray.)

neum, making it more accessible to the Operator. When once the knife has entered the groove and the deeper part of the incision is being made, the staff is held with its handle perpendicular and its concavity up against the pubic arch and its point well in the bladder. When all is ready for the incision, and the

staff is in position, the Surgeon should examine, by rectum, for staff, prostate, and ischial tuberosities _ and then change gloves.

Landmarks.—Central tendinous point of perineum; median raphé; anus; ischial tuberosities.

Incision.—From a point about 8 mm. ($\frac{1}{3}$ inch) to the left of the median raphé and just posterior to the central tendinous point of the perineum (which is 3.2 to 3.8 cm., or $1\frac{1}{4}$ to $1\frac{1}{2}$ inches, anterior to the adult anus) _ to a point between the ischial tuberosity and the posterior portion of the anus, and one-third nearer the tuberosity than the anus (according to others, midway between the tuberosity and the anus) _ making a total incision of from 5 to 7.5 cm. (2–3 inches). (See Figs. 4723, A and 4724, A.)



Fig. 4725.—Perineal Cystotomy; _ Illustrating the general method of making the perineal section, upon the staff _ in either lateral or median perineal cystotomy _ the lateral view of the technic being practically the same in both procedures.

Operation.—With the staff in the first of the positions indicated above, the superficial incision is made in the form of a thrust _ the operator steadying the perineal tissues with his left fingers _ and directing the point of his knife at a right angle to the perineum, with its back uppermost, enters its point at the upper limit of the above incision _ and aims directly for the groove upon the lateral aspect of the staff, but does not attempt to actually reach it, though he may do so and enter it at once. The incision is made as the knife is withdrawn, following the above line of incision _ is about 7.5 cm. (3 inches) in length, and grows less deep as it passes backward and outward. The structures cut in the superficial incision are, in order: integument; superficial and deep layers of superficial fascia; transversus perinæi muscle; transverse perineal artery, veins,

and nerves; lower margin of superficial layer of triangular ligament; hemorrhoidal vessels and nerves.

With the staff now in the second one of the positions indicated above, the left index is introduced into the upper angle of the wound and feels for the staff – and, with this finger held in position as a guide, with the nail turned so that it enters the groove, or is directly over it, the knife is passed, with the back of the blade uppermost, along the back of the forefinger and nail straight into the groove – either the knife with which the superficial incision was made or a special probe-pointed lithotomy knife (Fig. 4725). The point of the knife having been well engaged in the groove of the staff, the second or deep incision is now made – by pushing the knife downward and backward, depressing the handle as the knife goes forward to prevent its leaving the

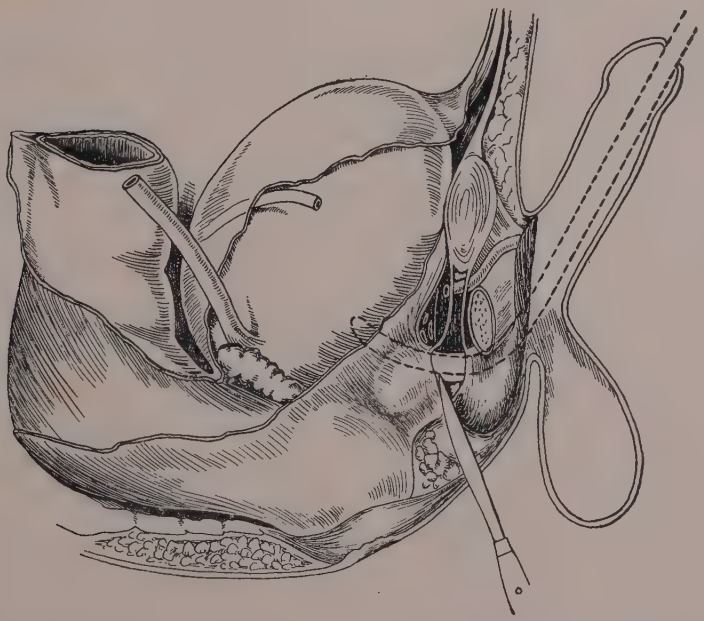


Fig. 4726.—Sectional View of Perineal and Pelvic Structures Involved in Median and Lateral Perineal Cystotomy; – The knife is seen passing through the median perineal structures, and incising the membranous urethra between the bulb, in front, and the prostate gland, behind. (The anatomy modified from Gray.)

groove, the point kept constantly in the groove, and the sides of the knife parallel with the edges of the now deep wound, and inclined to the left – until the lower end of the knife passes through the prostate gland and neck of the bladder – as evidenced by a gush of urine. The deep opening into the bladder is then enlarged to the extent considered necessary by bearing gently upon the cutting end as the knife is withdrawn – ceasing to use pressure, and, therefore, cutting force, as the knife reaches the more superficial planes of the wound. The structures cut in the deep incision are, in order – membranous and prostatic parts of the urethra; superior or deep layer of triangular ligament; compressor urethræ muscle; anterior portion of levator ani muscle; left lateral lobe of prostate gland. The incision through the urethra and prostate will be from near the median line obliquely backward and outward (Fig. 4726).

In the case of a stone, the lithotomy forceps are introduced closed, along the finger in the bladder as a guide, preceded or not by the dilatation of the bladder, as indicated, and the stone is grasped and removed, aided or not by the fingers in the bladder. The interior of the bladder may be then irrigated, if débris or other cause call for it. A perineal lithotomy drainage-tube is inserted and the wound left open, or closed only at its extreme ends by suture.

Comment.—Where a calculus is lodged behind an enlarged prostate gland, or held by the bladder walls in some unusual position, or embedded, special manipulations of the lithotomy forceps are necessary. Large stones may be broken by the lithoclast and removed in pieces.

Contraindications to lateral perineal cystotomy for the removal of stone are: a large stone, enlarged prostate, and deep perineum, under which circumstances a suprapubic cystotomy would be done.

Hemorrhage during the steps of the operation is controlled by ligature, clamping, pressure, and hot douching.

Avoid cutting the bulb and its artery in front, the rectum behind, and the pudic artery laterally.

Incision too far posteriorly will cut the ejaculatory ducts.

Draw the penis well up over the staff as the deep cut is made, so as to pull the bulb up.

Incision through the neck of the bladder should not exceed about 2 cm. (¾ inch).

Stick to the groove in the staff after once reaching it.

Some difficulties, peculiar to the smallness of the parts, are encountered in lateral lithotomy upon children.

MEDIAN PERINEAL CYSTOTOMY

Description.—Incision of the bladder through the median perineal region, generally, for the removal of calculi. The operation is sometimes incorrectly called Median Lithotomy. The bladder is reached by incising through the apex of the prostate gland and the membranous portion of the urethra. A less free and extensive opening is thus given than by either the suprapubic or lateral perineal cystotomy. Resorted to, especially formerly, for small calculi, which are generally now treated by litholapaxy or by suprapubic cystotomy. The special instruments required are: a medially grooved lithotomy staff, and a long, narrow, straight knife with a double cutting point. The advantages of the median over the lateral cystotomy are the following: smaller wound; less hemorrhage; quicker healing. There is better drainage than in the suprapubic operation. The disadvantages are: that only small calculi can be removed, and that the bulb of the corpus spongiosum and the rectum are more apt to be injured.

Preparation.—As for lateral perineal cystotomy.

Position.—As for lateral perineal cystotomy. The medially grooved staff is held as in the second position assumed in lateral perineal cystotomy (see p. 546).

Landmarks.—Central tendinous point of perineum, median raphé, anus. (See Figs. 4723, B and 4724, B.)

Incision.—Begins at a point about 1.3 cm. (½ inch) anterior to the anus, in the median raphé, and extends upward for 2.5 cm. (1 inch).

Operation.—The Operator puts his left gloved index-finger into the rectum and presses it against the staff, which has already been inserted and held as just mentioned, pressing against the staff at the apex of the prostate gland, thereby steadying and recognizing the deep relations, guarding the

rectum, and following the penetration of the knife. The long, narrow, double-edged knife, with the main cutting edge upward, held at a right angle to the perineum, is first thrust directly inward and made to at once strike and enter the grooved staff at the apex of the prostate, passing through the apex of the gland itself where the finger steadies it within the rectum. The knife is then made to cut upward in the groove of the staff _ and, in the act of with-



Fig. 4727.—Median Perineal Cystotomy _ I; _ Incising the membranous urethra upon the median groove of the staff, guided by the nail of the left index-finger.

drawal, makes a wound in the soft parts of about 2.5 cm. (1 inch) _ depressing the handle of the knife in cutting the urethra and elevating it in cutting the superficial parts, _ incising the following structures: _ integument; both layers of superficial fascia; anterior portion of external sphincter ani; central tendinous point of perineum, lower margin of triangular ligament; membranous urethra; compressor urethræ; apex of prostate gland.

As the knife is withdrawn the index-finger is introduced into the bladder directly upon the original staff _ or such an instrument as Little's director is introduced upon the staff through the perineal wound and the original staff then removed _ and the finger introduced upon the second director through the neck of the bladder, which is often entered with difficulty.

The bladder cavity is thus examined through the original wound _ or the opening through the neck of the bladder may be first dilated if necessary. The special object of the operation is then accomplished in the same manner described under the lateral perineal cystotomy. In completing the operation a perineal lithotomy drainage-tube is not usually used _ the wound being simply left open _ protected by a thick perineal dressing.

Comments—Instead of conducting the technic in the manner above described _ and avoiding the introduction of the finger into the rectum, and the



Fig. 4728.—The Same _ II; _ The bulbous tip of the grooved gorget has been carried into the incised membranous urethra _ and is being pressed backward as the staff is being lowered.

change of gloves, the Surgeon, while the staff is steadied by an Assistant, may incise in the median line of the perineum, bulged out by the convexity of the staff _ the incision coming to within 1.2 cm. ($\frac{1}{2}$ inch) of the rectum. This incision exposes the bulb, and the membranous urethra is made prominent in the wound by depressing the handle of the staff. The Surgeon then locates the central groove of the staff with his left nail, and, guided by this, incises the floor of the membranous urethra in the median line (Fig. 4727). The point of the knife, with its handle paralleling the urethra, is pushed on until the beginning of the prostatic urethra is cut _ after which the knife is with-

drawn. A grooved gorget is then introduced into the wound, with its bulbous tip in the incised urethra (Fig. 4728) _ the tip of the gorget following the groove of the staff into the bladder _ after which the staff is withdrawn _ and the Surgeon passes his finger into the bladder along the groove of the gorget (Fig. 4729). This method of procedure is better than the one first described.



Fig. 4729.—The Same _ III; _ The forefinger, guided by the gorget, is being carried along its groove _ through the incised membranous ureter _ into the bladder.



Fig. 4730.—Cabot's Graduated Bladder Gauze Tampon.

Free bleeding following perineal section may occur _ and, in such cases, such a graduated form of gauze tampon as seen in Fig. 4730 may be useful.

CYSTORRHAPHY

Description.—Suturing of bladder. Indications: _ Following cystotomy operations (except the perineal); wounds, occurring during operation, or at other times; rupture of the organ, etc. The peritoneal or non-peritoneal aspects of the bladder may be involved _ or both.

Operation.—The wound may be connected with any of the conditions mentioned above. The exposure of the wound, therefore, will be determined by the nature of the incision or injury. It will involve either the peritoneal or the non-peritoneal region of the bladder _ or may involve both. The same form of suturing is used, whether peritoneal or non-peritoneal surface be the site of operation. Several methods of approximating the edges are in use: _ (*a*) The margins of the bladder wound are brought together and carefully adjusted by means of a single tier of fine chromic gut, interrupted or continuous, carried upon a curved needle, and passing through all the coats except the

mucous. (*b*) The mucous membrane may be first united by interrupted or continuous gut suture _ followed by the approximation of the outer coats by the stitch just described under (*a*), either fine gut or silk being used. (*c*) By interrupted chromic gut Lembert sutures passing through the outer coats only, extending slightly beyond the wound at both ends. In the case of the peritoneal surface of the bladder, the serosæ adhere and unite. In the case of the non-peritoneal surface of the bladder the raw connective tissue covering the surface unites. (*d*) By a combination of method (*a*) as a first tier _ followed by method (*c*) as a second tier _ constituting probably the best technic (Fig. 4731).

Comment.—Catgut should always be used in sutures passing through the mucous membrane.

In no form of suturing should the mucous membrane be included in a suture which, at the same time, will pass through the outer coats.

If the circumstances of the wound and the technic of closure be such as to make the Operator feel confident of result, the external wound may be closed

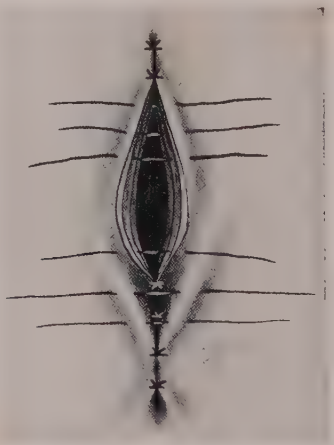


Fig. 4731.—Cystorrhaphy: _ First tier of sutures passes through outer coats and involves edges of bladder wound (shown in upper sutures). Second tier consists of Lemberts through outer coats, at a short distance from the margins (shown in lower sutures—which are here also seenburying in the first tier).

as usual. In all cases of doubt _ and the safest in all cases _ the external wound may be closed in greater part _ and temporary drainage be carried down to the bladder wound.

The bladder should be drained by the catheter for two or three days _ to avoid distention of the organ and strain upon the sutures.

CYSTOSTOMY—VESICAL DRAINAGE

Description.—By vesical drainage is meant the drainage of the bladder contents through a natural or artificial channel. Drainage by natural route is represented by drainage through the male or female urethra, by means of an ordinary catheter fixed in the urethra, or by a special, self-retaining catheter. The bladder is drained by an artificial channel when its cavity is exposed by a suprapubic, vaginal, or perineal cystotomy incision _ the retention of a patulous condition of the wound for the purpose of drainage constituting suprapubic vaginal or perineal cystostomy. The drainage may be of very temporary, intermediate, or permanent duration _ as practised, respectively,

for the relief of strain on the sutures following some bladder operation, – for obstinate and marked cystitis discovered at the time of the bladder operation, – and in cases of malignancy, exstrophy, and the like. Intermittent bladder irrigation may be practised in conjunction with bladder drainage.

Principles of Bladder Drainage.—Upon the surface of the subject, it would seem that drainage of the bladder by the perineal and vaginal routes would, unquestionably, offer the greatest advantages for gravity drainage, as tapping the bladder at levels ordinarily considered the lowest of the viscus. But in perineal drainage the drain first enters the membranous and prostatic urethra, and finally enters the bladder by the vesical orifice. Walker emphasizes the fact that while in a child standing erect, the lowest part of the bladder is the vesical orifice of the urethra, in the male standing erect the lowest part of the bladder is behind the internal urethral orifice – and that when he is lying on his back the lowest part of the bladder is well posterior to the interureteric bar (as Surgeons recognize in practising litholapaxy) – so that the rubber drain which enters the bladder through the vesical orifice is, he states, "several inches above the lowest part of the bladder." In contrast with this, he observes, a rubber tube passed into the bladder through a suprapubic wound, for drainage, goes down as far as the trigone of the bladder – and around this the bladder wall contracts, forming a tunnel, as it were, the lower end of which is the posttrigonal pouch – so that the drainage-tube passed in through the suprapubic opening really taps a lower level than one entering by the perineal route – and that if siphonage or suction be employed in connection with such a drain the bladder may be kept, for all practical purposes, dry.

The different types of bladder drainage will be described.

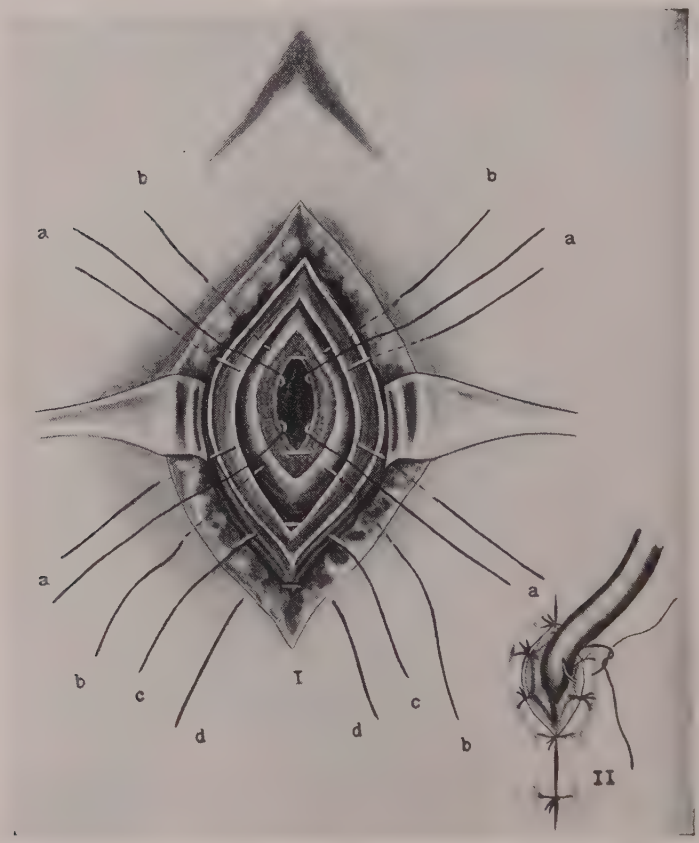
Urethral Bladder Drainage by Retained Catheter.—Consists in drainage by a soft-rubber catheter passed through the urethra into the bladder. Indicated for only brief drainage – not over three or four days, the usual limit of bladder toleration. A soft catheter is introduced until its eye has just entered the bladder, which is ascertained by withdrawing the catheter and retaining it in the position in which it was just before cessation of flow. Various devices are used for holding the catheter in the urethra. A 1 cm. (or ½ inch) width of rubber plaster may be passed three-fourths of the way around the penis (to allow of expansion of the organ) just behind the corona, and to this the tube may be tied by silk suture passed with a needle through the outer wall of the tube and upper border of the plaster band.

Instead of using an ordinary catheter for drainage, a special type of self-retaining catheter, the Pezzer, or mushroom catheters (v. Figs. 4662–4666) is often advantageously employed.

Suprapubic Cystostomy – Suprapubic Bladder Drainage Through a Suprapubic Cystotomy Incision.—Consists in drainage of the bladder through a suprapubic cystotomy incision. Drainage may be temporary or permanent – and various means for its execution have been devised – some of which will be here considered.

Technic of Suprapubic Cystostomy.—The suprapubic incision of the bladder is accomplished as described under suprapubic cystotomy (v. p. 525). Upon the completion of this operation the cystotomy is converted into a cystostomy (bladder opening or mouth). If the resulting bladder wound be longer than needed for simple drainage, one or both ends are closed by suture, down to the required size. Whether this be done, or the bladder incision be utilized as made, the margins of the bladder opening are sutured to the margins of the opening into the abdominal wall. The anchorage of the margins of the bladder incision into the abdominal wound is usually made into the

lower plane of the abdominal wound rather than to the skin – for the nearer to the normal level the bladder is anchored, the greater the ease of closure of the vesical fistula when no longer needed. The bladder wound is sometimes sutured directly to the skin in bad cases of cystitis. Albarran's technic of performing suprapubic cystostomy is shown in Figs. 4732 and 4733. Four different sets of sutures are there used. Sutures **a, a, a, a** pass through all the coats of the bladder, and through all the coats of the margins of the abdominal wound. Sutures **b, b, b, b** pass through the outer coats of the bladder,



Figs. 4732 and 4733.—Suprapubic Cystotomy – Albarran's Technic – I: – a, a, a, a, Sutures passing through all the coats of the bladder and all the layers of the abdominal wound; – b, b, sutures passing through the outer coats of the bladder and through the overlying muscles and skin; – c, sutures uniting the muscle margins; – d, skin sutures. II, – The wound sutured, with drainage-tube anchored.

and through the muscles and aponeuroses of the abdominal wound. Sutures **c, c** pass through the muscles and aponeuroses of the ends of the wound, to shorten the wound. And sutures **d, d** bring skin and fascia together at the ends of the wounds. It will be seen that though some of the sutures pass through all the coats of the bladder wound and all the coats of the abdominal wound in this technic, yet the bladder margins are not brought into contact with the skin margins – but simply up against the structures in the lower plane of the abdominal wound, and held in contact with these.

The method of making the cystostomy opening is practically the same

independently of the form of drainage to be adopted. A tube of fairly large size is usually employed. Some Surgeons advise rubber tubes of even 2 to 2.5 cm. ($\frac{3}{4}$–1 inch) diameter _ which might seem an excessive size _ holding that the bladder tends to grasp such tubes with less leakage.

Suprapubic Bladder Drainage by Single Siphonage Tube.—Following the suprapubic cystotomy a pliable rubber tube, of fairly large caliber, and with a lateral opening very near its lower end, is introduced through the bladder wound, which has been partly closed from both ends _ and so adjusted that its lower end barely reaches the trigone of the bladder, but does not rest

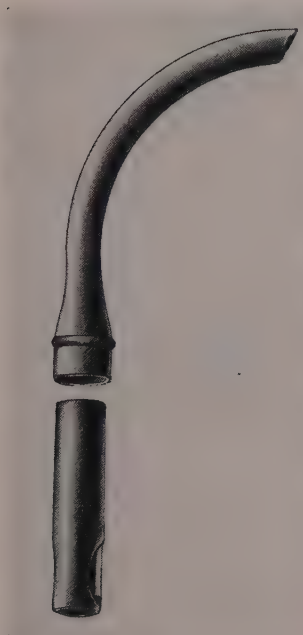


Fig. 4734.—Albarran's Modification of Freyer's Large Suprapubic Rubber Tube Drain _ the modification consisting in an adjustable attachment for prolonging the bladder drain to the urinal.



Fig. 4735.—Siphon Bladder Drain: _ a, Tube for irrigant inflow; _ b, tube for bladder outflow. (Modified from Albarran.)

upon it. A large safety-pin passed through its outer wall, at the skin level, rests transversely across the lips of the partially sutured wound and maintains the fixed depth of the tube. A large size gauze pad, with central perforation or split, is then placed around the tube, and a second safety-pin is passed in just above the second pad, to steady the tube. The free end of the drain is connected with a rubber tube, emptying into some reservoir provided to catch the urine. The superficial appearance of the wound when a single drainage-tube has been inserted into the bladder and anchored in the margin of the wound is as seen in II, Fig. 4733. The Albarran-Freyer suprapubic drain is seen in Fig. 4734.

Combined Suprapubic Bladder Siphonage and Irrigation by Double Tubes.—The use of double tubes, welded together in the making or held together by non-penetrating sutures (Fig. 4735) is often useful _ especially where irrigation, as well as drainage, is indicated, as in cases of infection or hemorrhage. The use of such tubes is shown in Fig. 4736. They are anchored in the wound in the same manner that the single tube is _ one tube serving as an inlet tube for irrigation, and the other as an outlet tube for siphonage. A small tube will prove a better siphon than a large one. A small tube, conducting the urine to a receptacle beneath the bed, may even act too powerfully, first exhausting the fluid from the bladder, and then drawing in air, which eventually interferes with the siphonage. An intermediate tube may

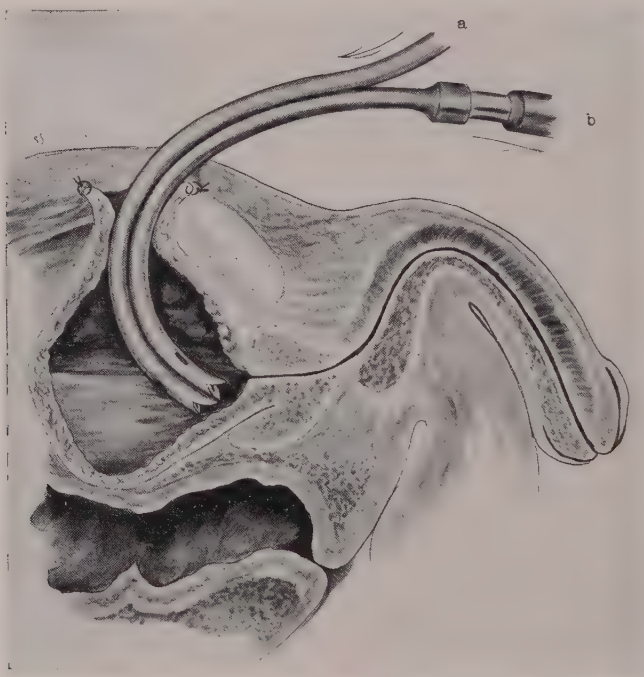


Fig. 4736.—Double Tube Bladder Drainage: _ a, Inlet; _ b, outlet, siphonage tube.

answer better _ but, all in all, siphonage drainage is not usually very satisfactory.

Suprapubic Suction Drainage of the Bladder.—A number of technical procedures have been suggested, uniting the principles of special bladder drainage and general suction drainage _ both of the water pump and of the electric types _ constituting more or less complex forms of apparatus. The best type of apparatus is probably the electrically driven suction drain, operated at fixed intervals.

Suprapubic Siphonage, or Suction Drainage of the Bladder, Through an Obliquely Buried Tube.—This is an application of the Witzel gastrostomy method (v. p. 559) to the bladder. The tube is first buried in the anterior wall of the bladder by several non-penetrating Lembert sutures (Fig. 4737). A stab incision is then made through all the coats of the bladder, opposite the tip of the tube _ through which the tube is protruded on into the hollow

of the organ. The incision through which the tube enters the bladder is closed by a continuation of the Lemberts which bury in the rest of the tube – the suturing passing a little beyond the site of the puncture of the bladder. Finally, the abdominal musculature and aponeuroses and the fascia and skin are brought together up to the exit of the drain (Fig. 4738).

Suprapubic Siphonage, or Suction Drainage of the Bladder, Through a Tube Introduced by the Gibson Method.—This is an application of the Kader gastrostomy method (Gen. Index) to the bladder. Where bladder drainage alone is sought, the bladder wall is exposed as for ordinary cystotomy – an opening is made in the middle line of the bladder, sufficiently large to admit the drainage-tube snugly – and in the median line, in front and behind



Fig. 4737.—Suprapubic Siphonage or Suction Drainage of the Bladder Through an Obliquely Buried Tube – Burying the rubber drain in the anterior wall of the bladder by non-penetrating Lembert sutures. The end of the tube is being made to enter the cavity of the bladder through a stab incision.

the tube, a Lembert suture of chromic catgut is placed, so as to closely embrace the tube. Or, if a larger incision has been made into the bladder than required for the drainage technic, its ends are first closed down to the tube by suture. These sutures constitute the first tier. A second tier of four sutures on the same plane is applied, two in front and two behind the tube (Fig. 4739). Another similar tier is usually applied, above the preceding (Fig. 4740). And, finally, a last tier of a single suture in front, and one behind is applied (Fig. 4741). The sectional view of these different tiers of sutures is seen in Fig. 4742. The bladder wall, invaginated around the drainage-tube, is seen in Fig. 4743. The technic of draining the bladder, after the insertion of the tube by the Gibson method, is either by siphonage or by suction. After

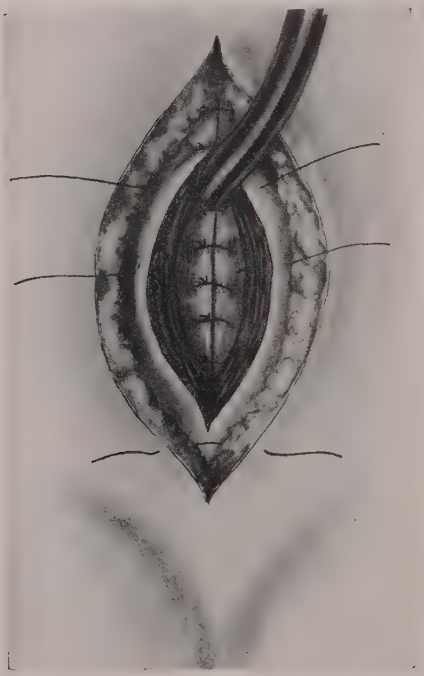


Fig. 4738.—The Same; The bladder has been closed over the tube by Lembert sutures – and the margins of the abdominal muscles are being united by buried sutures, some of which will also pass through the outer coats of the bladder, as anchoring stitches – after which the skin will be closed up to the exit of the drain.

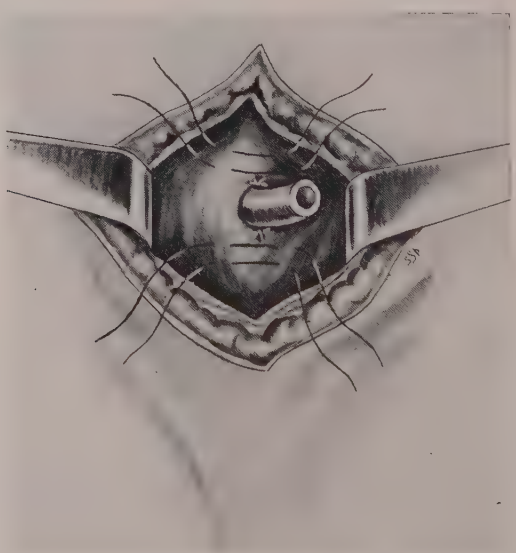


Fig. 4739.—Gibson's Bladder Drainage in Suprapubic Cystostomy – I; – The bladder incision has been closed up to the drainage-tube by a suture immediately above and below it. ¶ The first non-penetrating burying-in sutures, four in number, of the Lembert type, have been placed, but not tied

the wound has healed the tube may be temporarily withdrawn – and re-inserted through the valve-like opening.

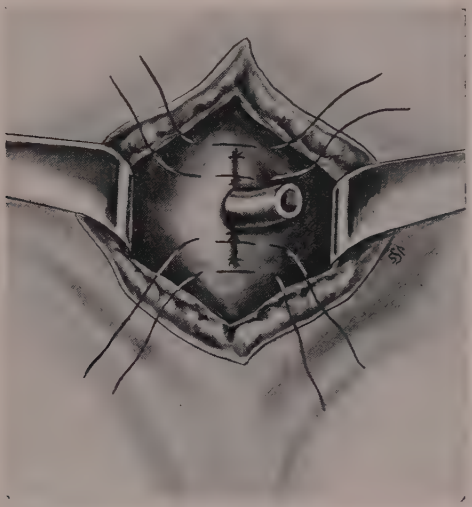


Fig. 4740.—The Same – II; – The first tier of infolding sutures have been tied and the second tier placed.

Permanent Suprapubic Drainage of the Bladder.—It may happen that the suprapubic drainage of the bladder must be more or less permanent – as, for instance, in such cases as malignancy of bladder, or prostate, or after ineffectual operation for exstrophy.

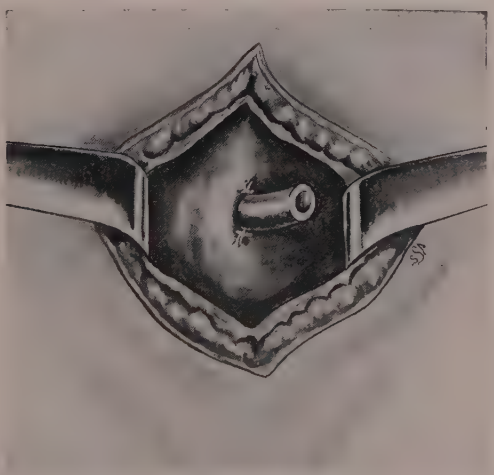


Fig. 4741.—The Same – III; – The third or final tier of walling-in sutures consists of two, closely gathering the bladder wall around the tube.

In cases in which the drainage is meant to be temporary, the suprapubic drain may be usually removed in four or five days – and the fistula generally heals within two or three weeks.

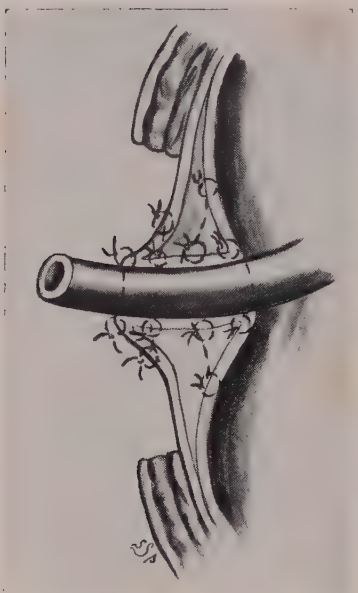


Fig. 4742.—Gibson's Bladder Drainage in Suprapubic Cystotomy; – The three, or four tiers of sutures (four here) shown in Figs. 4739–4741 are here seen in sectional view.

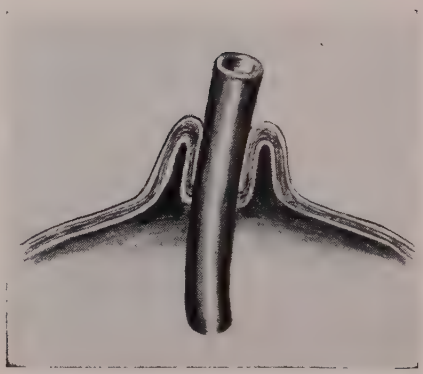


Fig. 4743.—Gibson's Valvular Colostomy; – Showing in cross-section the tube embedded within the intestinal lumen by the invaginating sutures.

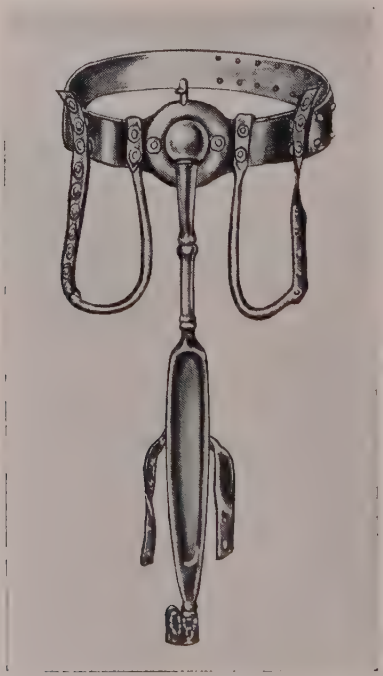


Fig. 4744.—Urinal for Exstrophy of the Bladder or for Urinary (Vesical) Fistula.

In cases, on the other hand, where a suprapubic fistula remains indefinitely, some form of permanent portable urinal must be worn – of which there are many varieties – a common form being shown in Fig. 4744.

Perineal Cystostomy – Perineal Bladder Drainage.—Consists of the drainage of the bladder through the perineum by means of a tube, or through the bare wound resulting from perineal cystotomy. Indicated chiefly in operations upon the bladder by the perineal route and in cases of impervious urethra. Where the drainage is the primary consideration (as in aggravated cystitis and in other conditions of prostate, bladder, or urethra) the membranous urethra is opened by median perineal incision, just as in external urethrotomy

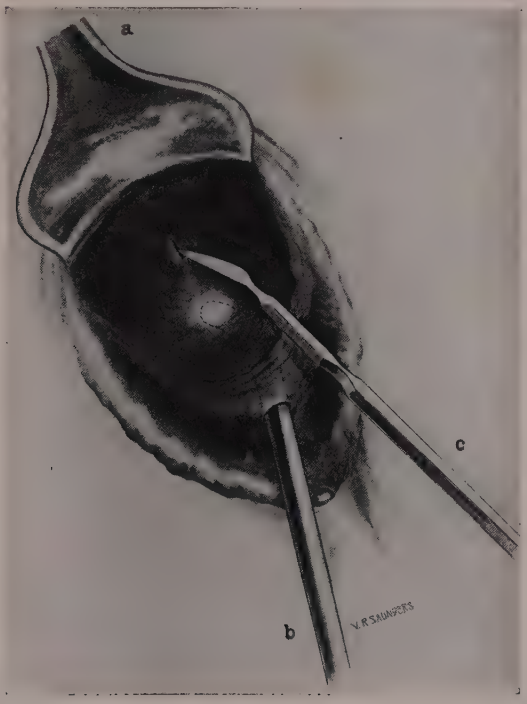


Fig. 4745.—Vaginal Cystostomy, in Sims' Position, for Temporary Drainage in Obstinate Cystitis – I: – a, Retractor displacing posterior vaginal wall; – b, sound introduced through urethra into bladder and then reversed, so that its point impinges upon the vesicovaginal wall, bringing it prominently into the vaginal field; – c, Simon's obliquely angular knife penetrating the vaginovesical wall, well below the cervix and cutting its way toward, but not to, the neck of the bladder.

(q. v.) – the catheter is carried through the prostatic urethra into the bladder until its eye rests just within the bladder cavity – and is then fastened to a T-bandage by a silk suture carried on a needle through the outer wall of the catheter. A long rubber tube is then connected with the catheter and carried to a bottle at the foot of, or under, the bed, and drains by siphonage.

The rubber drain may be a large size rubber catheter, with velvet tip and terminal and lateral openings. It should project just beyond the sphincter of the bladder – which is determined by throwing fluid into the bladder, after which the tube is withdrawn slowly, until the flow from the tube ceases – and then the tube is pushed back just far enough to clear the internal meatus of the urethra.

Special forms of perineal rubber drains are also made, with or without metallic and glass attachments.

Perineal drainage is always planned to be temporary – as, except for gravity, the conditions for drainage are unfavorable both from the standpoints of infection and the necessity of remaining upon the back.

Median perineal drainage of the bladder is accomplished as described under Median Perineal Cystotomy (v. p. 550).

Vaginal Cystostomy – Vaginal Bladder Drainage.—Consists in drainage of the bladder by means of an incision through the vaginovesical septum – and is accomplished as described under vaginal cystotomy (v. p. 543). In addition to the methods there described, the vesicovaginal septum may be conveniently incised by placing the patient in Sims' position, with the parts

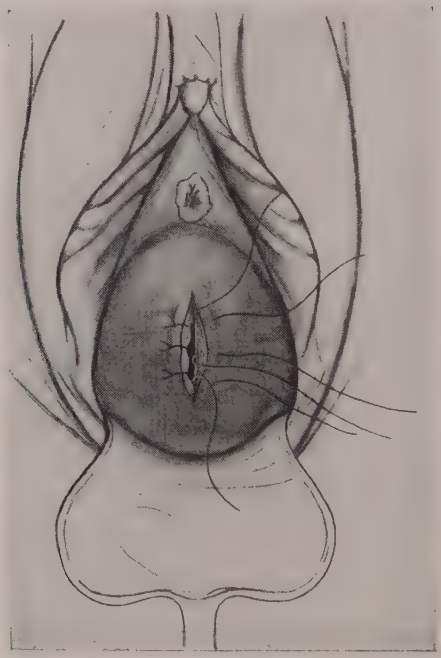


Fig. 4746.—Vaginal Cystostomy; – Following vaginal cystotomy, drainage may be established by suturing the bladder and vaginal mucosa together by through-and-through catgut stitches

exposed by a Sims speculum – a sound is then carried through the urethra, into the bladder, and made to prominently pouch the base of the bladder into the vagina – after which a median incision is made through the base of the bladder by means of an angular knife, posterior to the tip of the sound, and extended to the desired extent (Fig. 4745). In those cases in which the cystostomy may have been made, originally, for such purpose as, for example, the removal of a vesical calculus, it may be convenient to place a temporary stay suture in the middle of each lip, to aid in the control of the lips of the wound during the necessary manipulation of removing the calculus. In concluding the operation, and to provide against the too early closure of the fistulous opening, before the object of drainage can be accomplished, it is well to place a few marginal catgut stitches, uniting the vesical and vaginal mucosæ (Fig. 4746). The vesicovaginal fistula, however, is more apt to be too long

in healing rather than too rapid _ and to require surgical means for the closure at the end of the period of its usefulness.



Fig. 4747.—Female Rubber Urinal for Day and Night Use.

A form of female urinal, for use in such cases, is seen in Fig. 4747.

OPERATIONS FOR VESICAL CALCULI, IN GENERAL

"Litholapaxy is the operation of choice in patients of all ages and of both sexes" _ Freyer.

He further states that there is but little choice, as far as mortality is concerned, between lateral perineal cystotomy for calculus and litholapaxy, in males under puberty _ but that convalescence after the former must be reckoned by weeks, while, in the latter, it may be counted by days.

While, then, giving the preference to litholapaxy, for vesical calculi, in general, he considers that the following conditions are inappropriate for litholapaxy, and are best met by the operative methods mentioned: _ (*a*) Very large, very hard calculi, approximating 2 ounces and over (but not, necessarily, large, soft stones) _ suprapubic cystotomy; _ (*b*) Encysted calculi _ suprapubic cystotomy; _ (*c*) Calculi impacted in and not dislodgable from the prostatic urethra into the bladder _ median perineal cystotomy; _ (*d*) Calculi in an irritable, rigid and contracted bladder, intolerable of the requisite fluid for litholapaxy _ lateral perineal cystotomy, for larger stones _ and median perineal cystotomy, for smaller ones; _ (*e*) Coexisting calculus and vesical tumor _ suprapubic cystotomy; _ (*f*) Coexisting close, fibrous urethral stricture and vesical calculus _ median perineal cystotomy (unless the size of the stone necessitates suprapubic cystotomy); _ (*g*) Coexisting prostatic enlargement and vesical calculus _ suprapubic cystotomy, for the removal of the prostrate and the calculus.

Keyes, writing some years ago, made a statement generally considered as true today as then: _ "Of all the operations that are or have been employed in the treatment of stone in the bladder, litholapaxy, when properly performed, is generally conceded to be the safest and most brilliant. In support of this

proposition it is only necessary to adduce the authority of Cabot and Chismore in this country, of Thompson and Harrison in England, of Guyon in France, and of the entire school of Indian Surgeons, who, alone, see more cases of stone than all the rest of the world put together."

In India the lateral perineal operation is the one most frequently performed.

Freyer concludes, from inquiries, that the mortality is in favor of the lateral perineal operation in London and in the provincial hospitals _ and further concludes, unhesitatingly, that, in the hands of the general Surgeon, the results, in the treatment of stone, are best following some cutting operation.

Hugh Cabot considers that there are only two methods of operating for vesical calculus _ litholapaxy and suprapubic cystotomy _ entirely eliminating both lateral and median perineal cystotomy from the field. In assigning the limitations of these two technics he states, _ "Suprapubic cystotomy is applicable to any patient, large or small, young or old _ while litholapaxy can be applied only to the patient whose urethra is passable, or can safely be made passable, to satisfactory instrument" _ which would exclude all small children, as well as larger children with large stones _ and, further, holds that litholapaxy is only applicable to patients whose involvement is that of calculus alone _ and that those in whom there is some other coexisting bladder involvement must be subjected to cystotomy.

Watson and Cunningham have collected 33,871 cases of vesical calculus, irrespective of age, operated upon by the following methods _ the numbers of each group and the mortality being as stated: _ By litholapaxy, 17,736 cases, with mortality of 2.4 per cent., _ By lateral perineal cystotomy, 11,963 cases, with mortality of 9.8 per cent., _ By median perineal cystotomy, 425 cases, with mortality of 13.7 per cent., _ By Suprapubic cystotomy, 3303 cases, with mortality of 13.2 per cent.

From the above statements it will be seen that considerable divergence of view still exists in this, one of the very oldest branches of operative surgery.

For the average Surgeon, inexperienced in operating for vesical calculus, suprapubic cystotomy is probably more often performed at the present time, in this country, than any other operation for stone.

Litholapaxy is usually safer, and the convalescence less painful, and infinitely shorter _ than obtained in any form of cystotomy.

Variety and Frequency of Vesical Calculi _ Sir Henry Thompson: _

(*a*) 977 Calculi in Male Adults: _ Uric acid, 551 _ Uric acid and phosphates, 92 _ Phosphates, 244 _ Oxalates and urates, 35 _ Oxalates, 34 _ Oxalates and phosphates, 18 _ Cystin, 3.

(*b*) 14 Calculi in Female Adults: _ Uric acid, 10 _ Uric acid and phosphates, 2 _ Phosphates, 2.

(*c*) 16 Calculi in Children: _ Uric acid, 10 _ Urates and phosphates, 3 _ Oxalate, 1 _ Oxalates and urates, 1 _ Phosphates, 1.

Constituency of Vesical Calculi _ Cabot.—Uric acid _ urates _ oxalate of lime _ phosphates of calcium, ammonium, and magesium _ urate of ammonium _ urate of sodium _ xanthin _ cystin _ indigo.

The most frequently encountered stone is that of uric acid, or urate _ the hardest, oxalate of lime _ the softest, phosphatic calculi.

Operative Procedures for Vesical Calculi: _

Lithotrity, or lithotripsy.

Litholapaxy.

Cystotomy _ suprapubic (v. p. 525) _ perineal (v. p. 546) _ vaginal (v. p. 543).

LITHOTRITY—LITHOTRIPSY

Description.—Lithotrity (λιθος, stone, and terere, to rub) — Lithotripsy (λίθος, stone, and τρίρειγ, to rub) — are expressions used to signify the crushing of vesical calculi at one or several intermittent sittings (from seven or eight to three or four days apart) without general anesthesia — the débris of the stone being left to be evacuated by nature's efforts. The instrument used is an ordinary lithotrite — and the manner of using it is the same as in litholapaxy, except no evacuator follows its use. The patient rests in bed, or may even remain up, while the disturbance of each sitting is passing by. The operation is now almost obsolete.

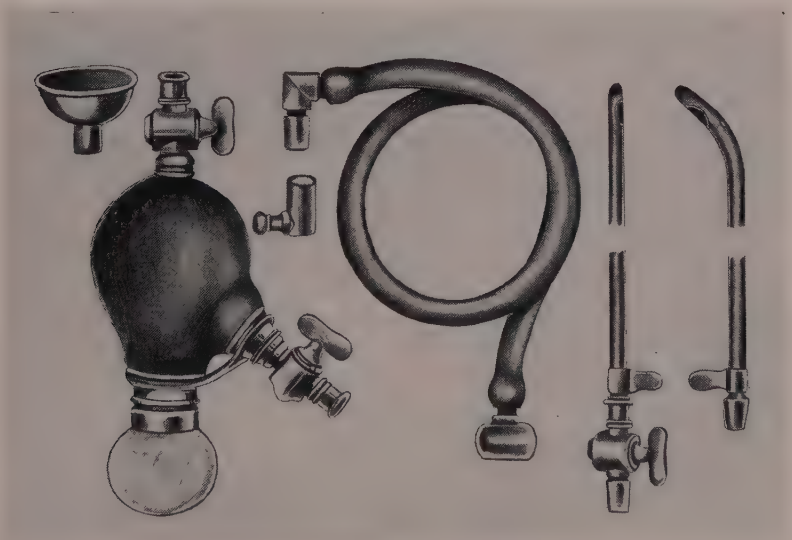
LITHOLAPAXY

Description.—Crushing of vesical calculi and recrushing of the resulting fragments, followed by removal of the débris by irrigation, at one sitting, usually under general anesthesia (sometimes under local). The crushing and



Fig. 4748.—Bigelow's Lithotrite.

removing are accomplished by special instruments — the lithotrite (Fig. 4748) and evacuator (Figs. 4749–4752).



Figs. 4749–4752.—Bigelow's Evacuator, with Connections.

Preparation.—Presence of stone verified by sound or cystoscope; bowels emptied; bladder and urethra in an aseptic condition and bladder moderately

distended with a sterile fluid (about 4 or 5 ounces). Anesthesia _ analgesia exceptionally.

Position.—Patient supine, with buttocks well raised by support, to cause the gravitation of the stone to the fundus of the bladder _ resting near the right edge of the table, with thighs separated. Surgeon stands upon the patient's right. Assistant opposite.

Operation.—The lithotrite, with closed blades, is introduced into the bladder just as a sound would be _ with the modification required by the straighter instrument more abruptly curved near its end _ that is, when the bulbous portion of the urethra is reached, the handle of the lithotrite, instead

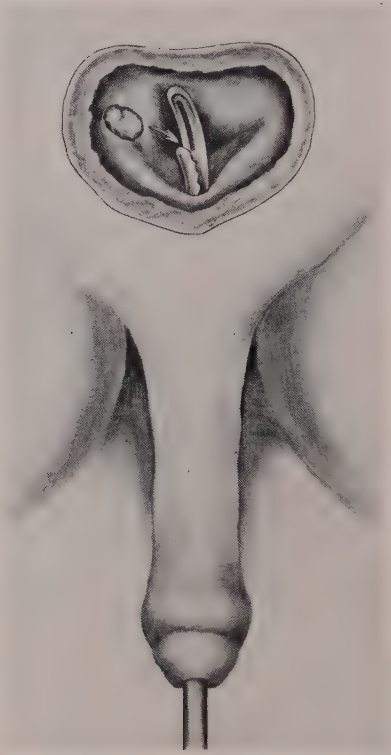


Fig. 4753.—LITHOLAPAXY; _ Depression of the instrument upon the trigone of the bladder, to cause the stone to gravitate into the hollow of the lower blade. The instrument may also be turned to right or to left, and manipulated so as to grasp the stone.

of being at once depressed (which would cause the point of the instrument to hook against the roof of the bulbous urethra in front of the triangular ligament), is held upright, so as to allow its more sharply curved point to gravitate beneath the triangular ligament and glide into the membranous urethra and reach the prostate _ and then only is the handle depressed, and slightly twisted from side to side, causing the tip to ride up through the prostatic urethra into the bladder _ and glide along the trigone to the posterior wall of the organ.

Slow, methodical movement in the opening and closing of the blades, with a pause between each movement _ together with a systematic search of the bladder cavity, should be the method adopted. Hurried movements cause bladder

currents, which generally keep the stone moving and make the grasping of the calculus difficult. Irregular, random movements in directing the grasping blades of the instrument are unsurgical and generally futile. The instrument may encounter the stone immediately _ and, if so, its position may be indicated and the blades opened for its seizure. If not, as the instrument rests quietly in the middle line of the base of the bladder, and steadily held in the one position, its blades are separated (by withdrawal of the male blade) _ then followed by a few seconds' cessation of all movements (to allow the stone to gravitate into the grasp of the instrument) _ succeeded by a gentle screwing-back of the male blade (the instrument being kept steadily, immovably in one position) _ when the stone will often be felt in the grasp of the separated blades (Fig. 4753). "Open _ pause _ close" is the formula of movement. If unsuccessful, open



Fig. 4754.—Litholapaxy; _ Inverting the blades of the lithotrite, to grasp a calculus in the fundus of the bladder.

again _ turn blades to right side, through an angle of 45 degrees ("right oblique"), still keeping the instrument in the median line _ close. Or turn it, from a vertical plane, through an angle of 45 degrees to the left ("left oblique") _ open _ close. Thus the instrument may pass from the vertical to a right or left oblique, or a right or left horizontal. It is better to open the blades before turning _ as the stone may be pushed away by an opening blade. Depress the handle, keeping in the middle line or turning laterally _ thus examining the anterior wall and sides of the bladder. Reverse the direction of the blades, so that they point downward, especially where the prostate is enlarged _ and examine the floor of the bladder and behind the prostate gland _ assuming the positions of reversed vertical, reversed right and left horizontal, and reversed right and left oblique (Fig. 4754). Thus the entire cavity of the bladder is systematicyall searched.

Having grasped a calculus (Fig. 4755), the male blade is steadily and slowly screwed down into the female blade — until the stone is felt to break into two

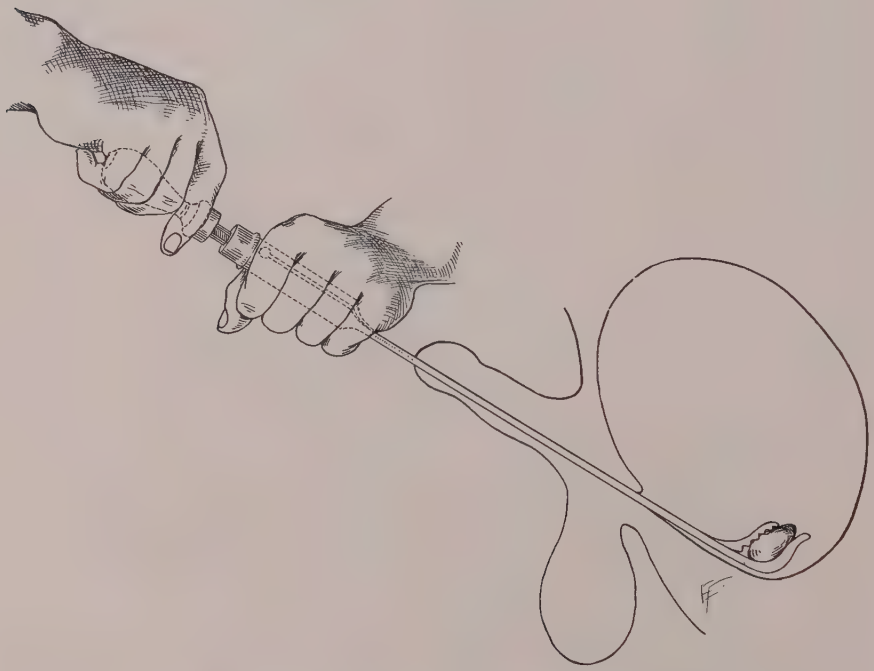


Fig. 4755.—Litholapaxy in the Male: — The lithotrite in position and the stone grasped.

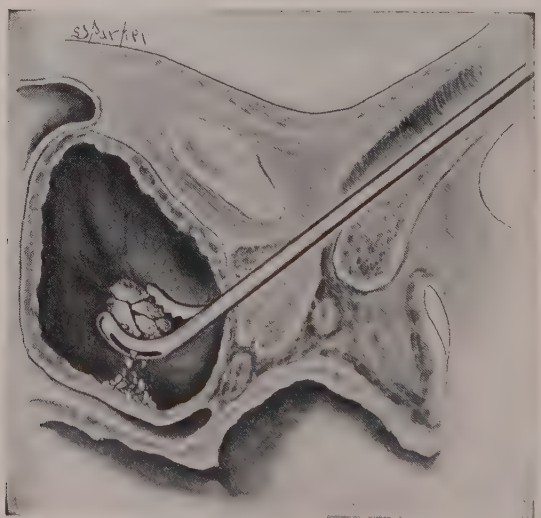


Fig. 4756.—Litholapaxy; — Lithotrite in the act of crushing a vesical calculus.

or more pieces (Fig. 4756). After pausing a moment the blades are opened, kept quietly apart a few seconds, then closed — either in the original or inverted

position – when probably several of the fragments will be caught and further crushed (Fig. 4757). This is repeated until the débris is considered to be fine enough to come through the tube of the evacuator. The blades of the lithotrite are then closely approximated while in the bladder and the instrument is withdrawn.

The tube of the evacuator is then introduced into the bladder and the urine or other fluid of the bladder is in part withdrawn. The opening of the evacuator lies in the lowerst part of the fundus of the bladder – so as to catch the gravitating stones. The bulb of the evacuator is then filled with warm boric acid solution and attached to the evacuator tube. While the left hand steadies the rigid tube in the bladder, the right hand compresses the bulb and throws a part of its contents into the bladder (about 2 or 3 ounces). On relaxing

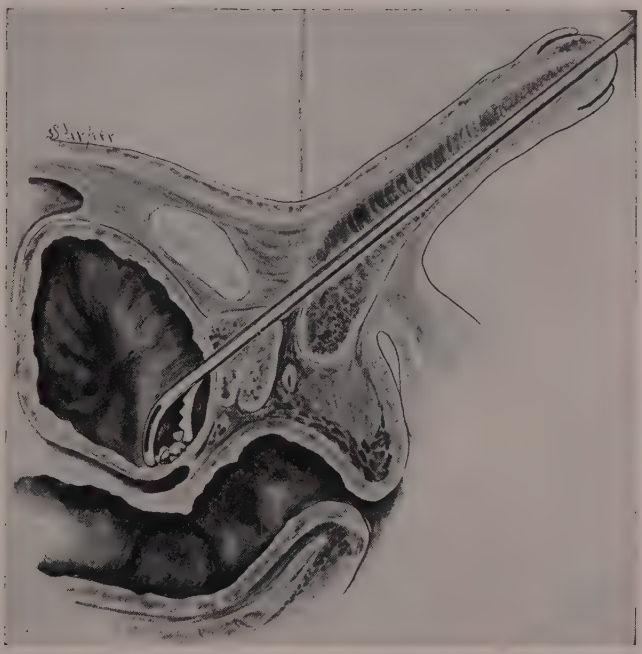


Fig. 4757.—Litholapaxy; – Inverting the instrument to pick up and rebreak some of the larger fragments of the crushed stone.

the bulb, as much fluid as was thrown in is drawn out again (so that the original amount always remains in), and with it more or less of the débris of stone is brought out in the outflowing current (Fig. 4758). Wait a few moments and then repeat the evacuating process – until all débris seems to have come away. If too large a fragment remains for evacuation, as determined by its ineffectual clicking against the evacuator, the lithotrite must be again introduced, the stone recrushed, and the evacuator reintroduced, and the débris further removed. Removal of all débris is generally determined by the absence of clicking – which is often heard at a distance, but is generally to be detected by the ear placed near the bladder – and by the coming away of perfectly clear and clean water. The bladder may be finally irrigated – and the evacuator withdrawn.

The patient is generally kept quietly in bed for a few days.

Comment.—Avoid grasping the mucous membrane of the bladder in the instrument, the construction of which usually makes it impossible or difficult (Fig. 4759). At any rate, before finally forcibly closing the blades, always shift the blades, so as to feel that they are free and have not included the bladder wall.

In evacuating débris, the bladder should not be allowed to get empty of fluid – as the walls of the organ would have a tendency to be drawn into the evacuator by suction.

If air enter the bladder, depress the handle of the evacuator so as to raise its tip above the level of the bladder fluid, and suck the air out with the bulb.

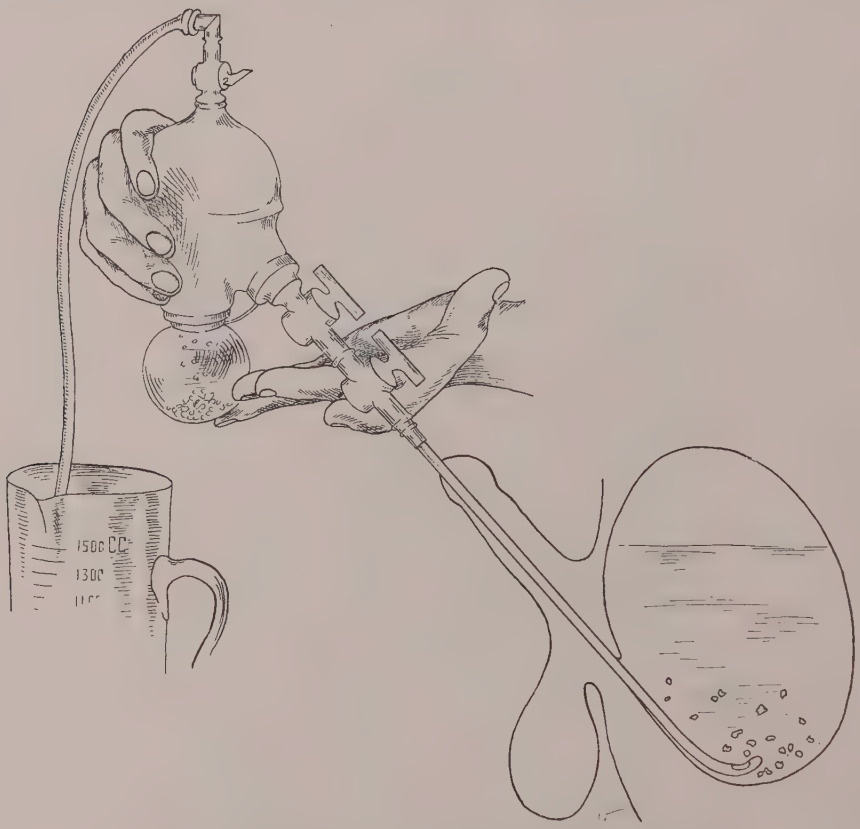


Fig. 4758.—Litholapaxy in the Male; – The evacuator in position.

If the instrument clogs and cannot, by persistent though gentle effort, be freed, it must be exposed and cleared through a suprapubic cystotomy.

Only a lithotrite with fenestrated blade should be used, thus lessening the chances of clogging.

It may be necessary to slightly incise the urinary meatus in order to get the beak of the instrument to enter the urethra.

Instruments of special size, as well as particular care, are necessary in operating upon children.

A simple instrument has been devised for combined crushing and evacuation by Chismore, which has proved very efficient in the hands of its deviser.



Ffg. 4759.—LITHOLAPAXY; _ Illustrating the possibility, in seeking the stone, of grasping a fold of vesical mucosa.

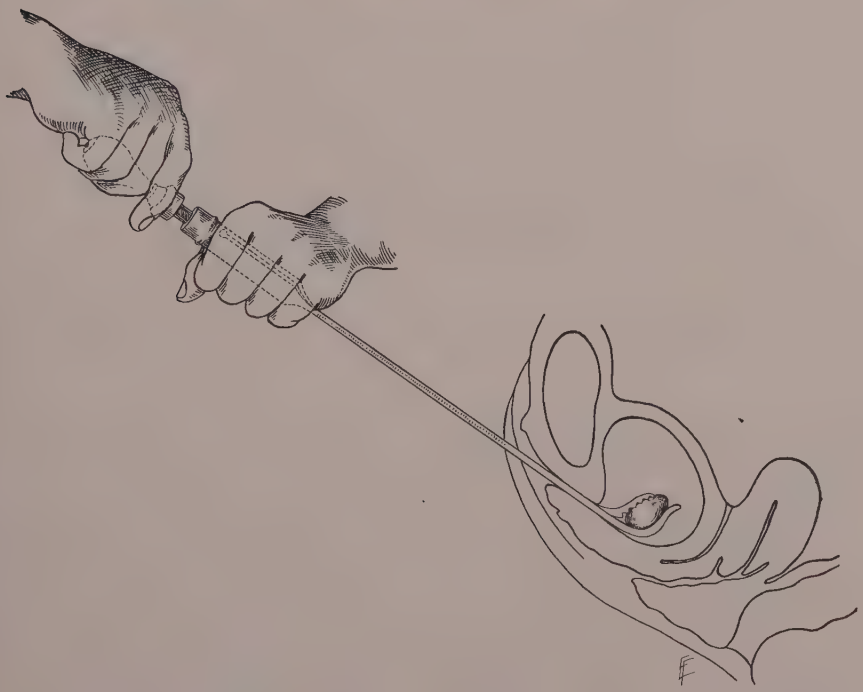


Fig. 4760.—LITHOLAPAXY IN THE FEMALE; _ The lithotrite in position, with stone grasped.

Litholapaxy in women is much more easily performed than in men, because of the shorter, larger urethra (Fig. 4760). The same type of instrument is used as in the male _ which comparatively young females can usually accom-

modate without preliminary dilatation of the urethra. Owing to their large, short urethræ, however, it is difficult to keep in the bladder the necessary fluid required for manipulation. To obviate this, Freyer gets his Assistant to slip the fore and middle fingers into the vagina and compress the urethral lips against the lithotrite _ which prevents the outflow of bladder contents. Women are often up the day after operation.

Where difficulty is experienced in carrying the lithotrite into the male bladder, the technic suggested by Duchastelet may be tried (Fig. 4761).

As both lithotrite and evacuator are manipulated from the patient's right, the Surgeon should pass these instruments from the right rather than pass them from the left, as urethral instruments are usually passed, and then walk around the table to use them.

It is often necessary to precede the passing of the lithotrite by the passage of several sizes of large sounds.



Fig. 4761.—Lithotrite Conducted Into the Bladder by Pliable Guide _ Duchastelet: _ a, Guide; _ b, c, two threads run through the substance of the guide transversely and held (not tied) by the closure of the instrument. When the blades are unlocked in the bladder, the guide, with its attached threads, is withdrawn. (Modified from Albarran.)

Following litholapaxy, especially in the male, the patient is put to bed for a few days _ and kept on bland fluids. An opiate is often administered at the end of the operation.

The difficulties most frequently encountered in the performance of litholapaxy are _ stricture of the urethra, hypertrophy of the prostate and large size of the stone, together with impaction or embedment.

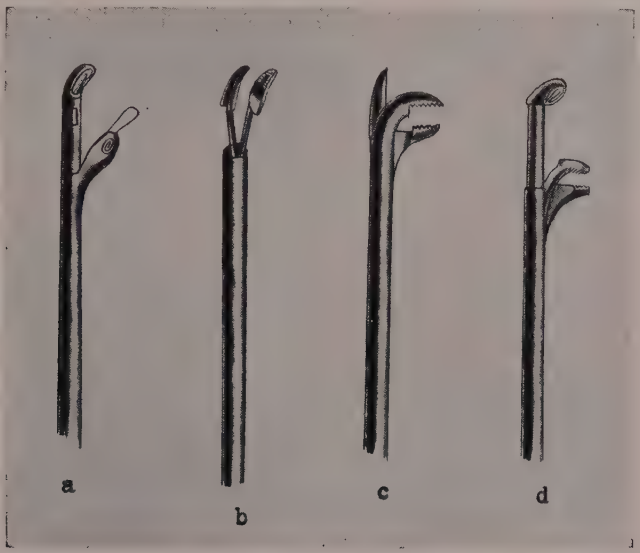
Correspondingly smaller lithotrites must be employed in the case of young males _ although the suction power of the evacuator is usually insufficient if its size be quite correspondingly decreased. If the urethra be too small, or the instrument fit too tightly, or the stone too large, litholapaxy should not be performed.

Analgesia has not proved generally satisfactory in litholapaxy _ much reflex disturbance being caused by the large amount of prolonged manipulation. Spinal and sacral analgesia have been successfully employed _ controlling, as they do, the terminal nerve endings in the bladder, thereby arresting bladder reflexes.

The condition of the urethra and the toleration of the bladder for fluids should be known in advance by trial.

In the average bladder from 100 to 150 c.c. of a 2 per cent. boric acid solution is introduced through a catheter, at the beginning of the operation.

The female blade of the modern Bigelow lithotrite is not fenestrated _ and it cannot clog. In using a fenestrated lithotrite, however, it is necessary to



Figs. 4762–4765.—Terminal Endings of Nitze's Operating Cystoscope: _ a, Wire snare; _ b, foreign body extractor; _ c and d, lithotrites. (Modified from Legueu and from Albarran.)

bring the blades into complete contact each time they are closed _ to prevent the partial projection of fragments of stone through the heel of the instrument, where they may be held as possible traumatizers of the bladder wall.

Sometimes the débris of crushed stone is so great that some of the crushed particles must be washed out with the evacuator before the crushing of the remaining larger pieces can be carried out.

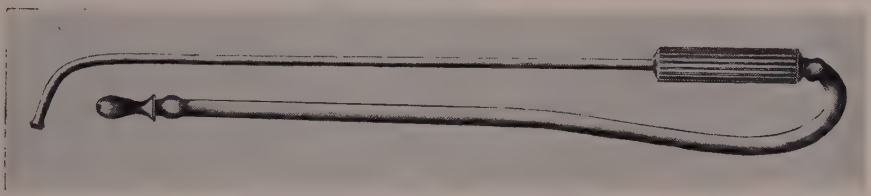


Fig. 4766.—Posner's Acoustic Stone Searcher.

Sometimes a fragment of stone will become impacted in the eye of the evacuator _ in which case the bulb is detached, and an effort made to dislodge the fragment by a metallic stylet passed down the evacuator. If successful, the bladder is again partly filled with fluid, and the evacuation continued.

Following what has been a complete evacuation of the calculous débris, this should be verified by cystoscopic examination of the bladder cavity. If sufficient clearness of medium exists at the time, the cystoscopy should

be performed immediately following the litholapaxy, at the same sitting - otherwise, a few days later.

Forms of instruments have been constructed which combine both cystoscopy and lithotrity so that the stone is crushed directly under the eye (Figs. 4762–4765).

Besides locating vesical calculi by *x*-raying and by cystoscopy, in advance of undertaking any form of operation, the acoustic sound is sometimes of use for the same purpose (Fig. 4766).

When the bladder is not sufficiently distended with fluid there is added possibility of sucking its wall into the eye of the evacuator.

Perineal litholapaxy is sometimes performed by introducing a lithotrite through a perineal cystotomy wound - after which the stone is seized and crushed in the usual manner.

OPERATION FOR VESICAL CALCULUS BY CYSTOTOMY

Decription.—The removal by forceps, or scoop, of a stone from the bladder, through an opening made in some part of the bladder wall. The routes by which this is accomplished are, the suprapubic, the perineal, and the vaginal - and the operative technic by which it is carried out has been



Fig. 4767.—Lewkowitz's Curved Lithotomy Forceps.

described under suprapubic cystotomy (v. p. 525), perineal cystotomy (v. p. 546), and vaginal cystotomy (v. p. 541). The method of opening the bladder by these routes is the same, irrespective of the object to be accomplished after the opening.

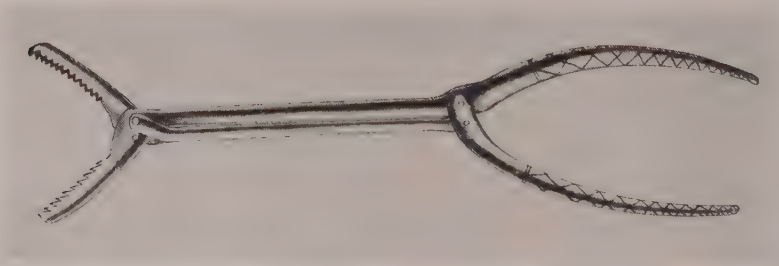


Fig. 4768.—Gouley's Lithoclast.

The terms "suprapubic lithotomy," "perineal lithotomy," and "vaginal lithotomy" are incorrect.

Removal of Vesical Calculi by Suprapubic Cystotomy.—The bladder is exposed and incised by the technic described and illustrated under Supra-

pubic Cystotomy (p. 525). Upon opening the bladder and locating the stone, either digitally, or by illumination, a pair of special forceps (Figs. 4767 and 4768) are introduced, the stone seized, and carefully withdrawn. Should there be such disparity between the seized stone and the incision for its withdrawal as to necessitate its bodily traction through the opening, the incision



Fig. 4769.—Freyer's Double-ended Lithotomy Scoop.

is enlarged with scissors rather than traumatize the margins of the wound with a stone too large to pass through it easily. Some calculi are more readily removed by means of a special scoop (Fig. 4769), aided by an index-finger – especially if there be several – or a calculus be broken into fragments. Upon completing the removal of the stone, or stones, the bladder cavity is flushed



Fig. 4770.—Removal of a Vesical Calculus Through a Suprapubic Cystotomy Wound.

with warm 2 per cent. boric acid solution. The technic of removal is seen in Fig. 4770.

The question of drainage is the same as comes up in relation with cystotomy in general. Under favorable conditions the bladder may be closed by the usual double tier of sutures. In questionable cases, temporary drainage

by rubber tube is safer — the bladder wall being closed up to the exit of the drain.

Removal of Vesical Calculi by Lateral Perineal Cystotomy.—The bladder is exposed and incised by the method described and illustrated under Lateral Perineal Cystotomy (p. 546). Having opened the bladder by the left lateral oblique incision through the perineal structures — and enlarged the opening, if necessary — the Surgeon introduces his left forefinger along the perineal wound and into the bladder. As soon as he is assured that his finger is within the bladder, and the stone has been located — and that the bladder incision is of sufficient size — the groove staff is withdrawn — and the special stone-grasping forceps are carried into the bladder. The finger is, at this time, also usually withdrawn, but it is a satisfaction to keep it within the bladder as a guide in directing the forceps to the stone. Upon separating the blades of the forceps, whether the finger has been kept in the bladder or not, a gush of bladder fluid usually occurs — which may flood out the stone, or wash it into the jaws of the forceps. In the event that the stone must be sought, it is carefully seized, when found, and carefully lifted from its position, to see that no neighboring vesical mucosa is also held by the forceps — and then slowly and carefully withdrawn, with a combined rotatory and rocking movement of the forceps, so as not to traumatize the perineal wound by its surfaces. The wound may have to be further incised to admit of the exit of the stone — which should be so seized by the forceps as to present its smallest diameter to the perineal wound. It should never be taken for granted that the stone removed is the only stone in the bladder — until this be corroborated by further digital examination — which is accomplished bimanually, with one finger in the bladder, and the opposite fingers compressing the distant portion of the bladder against this finger, from without. Sometimes a scoop will be useful in removing the stone, and especially in removing débris of a broken stone, or several small stones. If bleeding follow the operation, a large rubber tube is carried into the bladder for urinary drainage, and this is packed around with gauze, where it passes through the perineal wound, for control of bleeding. Superficial bleeding vessels are, of course, clamped and tied — although some of the deeper perineal vessels can only be reached sufficiently to clamp, leaving the clamps *in situ* for a day or two. If the perineum be very deep, the finger may not be able to reach the bladder, and a gorget or director may have to be used in its place. After the bladder has been once entered, and until the end of the operation, an instrument or a finger should always be within the bladder, until replaced by another, as, once lost, the bladder may be difficult, or impossible to recover. The excess of the perineal wound may be closed at the ends by suture. The bladder is irrigated daily with warm boric solution for several days — after which the perineal tube can usually be withdrawn, and the wound allowed to heal.

Removal of Vesical Calculi by Median Perineal Cystotomy.—The bladder is exposed and incised by the method described and illustrated under perineal cystotomy (p. 550). This method admits of the removal of calculi of only moderate size (that is, smaller stones than those removable by the lateral perineal cystotomy) — and such stones are generally better removed by suprapubic cystotomy. The operation is as described under median perineal cystotomy as far as opening the bladder is concerned — and the removal of the stone, in the median operation, is practically the same, in technic, as just described in the operation for the removal of vesical calculi by the lateral perineal route. The floor of the membranous portion of the urethra is incised — but this incision is only carried backward far enough to just nick the apex of the prostate gland. At this stage a blunt gorget is made to follow into the

bladder the median groove of the staff used in making the initial incision — after which the staff is withdrawn, and the finger follows the gorget into the bladder — the gorget then being withdrawn. The manipulations for the stone and the perineal drainage are the same as in the last operation.

Removal of Vesical Calculi by Vaginal Cystotomy.—The bladder is exposed and incised by one of the methods described under vaginal cystotomy (p. 543) — in the dorsal, or in the knee-chest position — or in Sims' position. The calculus is first located in one of the usual ways — by *x*-ray, cystoscopy, or sound. The incision through the anterior bladder wall must be made posterior to the vesical opening of the urethra, and for the purpose of readily recognizing this Kelly suggests the introduction of a mushroom catheter, whose expanded end is drawn against the orifice of the vesical opening of the urethra, demonstrating its position. The vesicovaginal wall is incised

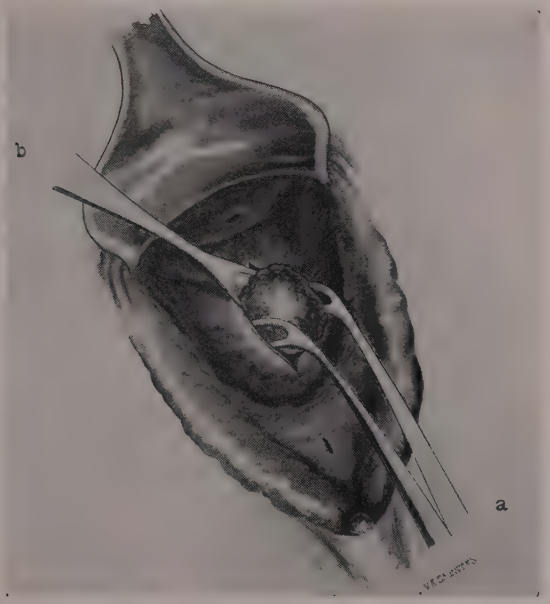


Fig. 4771.—Colpocystotomy, in Sims' Position, for Vesical Calculus — I: — a, Curved bladder forceps in the act of extracting a calculus through an incision made in the vaginovesical wall; — b, bladder scoop levering out the calculus over the margin of the wound.

by a stab cut, and the opening is enlarged by knife or scissors. Through the opening thus made a pair of special, curved vesical forceps is introduced into the bladder, seizes the stone, and carefully withdraws it through the wound in the vesicovaginal septum (Fig. 4771). It may be indicated in marked infection to drain the bladder through the vagina, following extraction of the stone — but Kelly advises in the majority of cases to close the wound in the vesicovaginal septum by non-penetrating sutures at once — and then drain the bladder by means of a mushroom catheter *via* the urethra, as well as maintain daily irrigations.

FISTULÆ OF THE MALE AND FEMALE GENITO-URINARY TRACT, IN GENERAL

It will be seen — from Figs. 4772 and 4773 — that probably the majority of fistulæ of both the male and the female genito-urinary tracts assume their

chief importance and inflict their chief distress through the leakage of urine from either the vesical or urethral tract, along fistulous channels, into con-

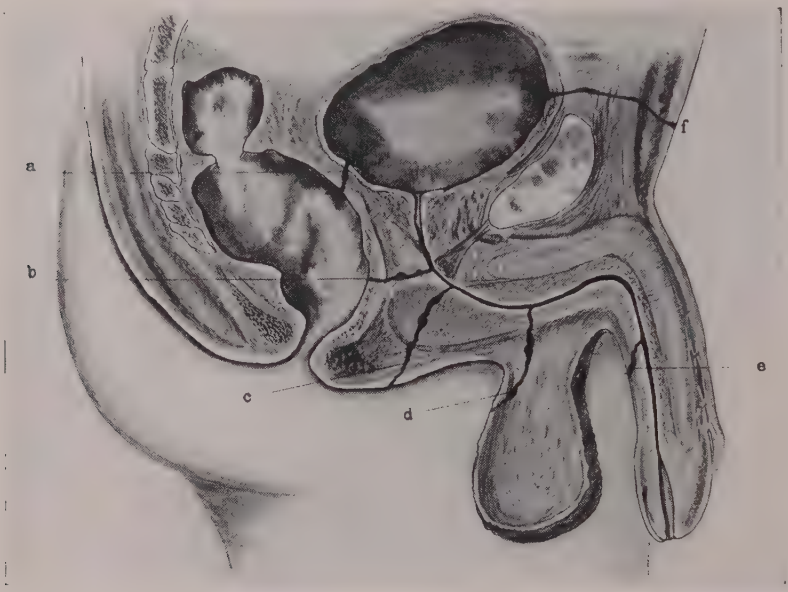


Fig. 4772.—Fistulæ Connected with the Male Genito-urinary Organs: – a, Vesicorectal fistula; – b, urethrorectal fistula; – c, urethroperineal fistula; – d, urethroscrotal fistula; – e, penile fistula; – f, suprapubic fistula.

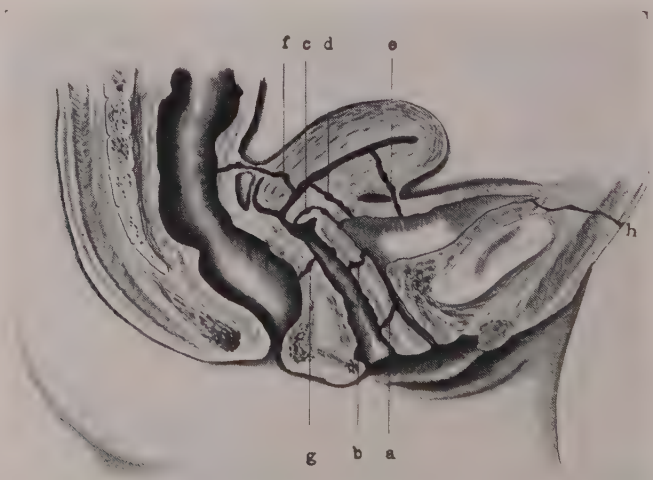


Fig. 4773.—Fistulæ Connected with the Female Genito-urinary Organs: – a, Urethrovaginal fistula; – b, vesicovaginal fistula; – c, vesico-cervico-vaginal fistula; – d, vesico-uterine fistula; – e, vesico-uterine fistula, through adhesions of bladder to uterus; – f, uterorectal fistula, through adhesions of uterus to rectum; – g, vaginorectal fistula; – h, suprapubic fistula.

tiguous or adjacent viscera or structures – while those in which the rectum forms the opposite end of the fistulous tract reciprocate on this score, and,

in addition, form, besides the more disagreeable, also the more dangerous element of the contribution.

Further, it will be readily understood from these illustrations, in connection with fistulæ of the strictly urinary tract, that the majority, though not all, of the operative technics practised for the cure of these fistulæ are conducted upon or through the organ or structure through which the urine finds its outward leakage. For this reason, therefore, the operative procedures for the repair of fistulæ connected with urinary leakage will be found as a rule described under those organs, or structures, through the tissues of which the principal operative manipulation takes place.

Owing to the nature of the pathology of urinary fistulæ, or composite fistulæ – and to the multitude of operative measures undertaken for their relief – there can be no hard-and-fast rule in the matter – but, as a general working basis the scheme above alluded to will be followed – the exceptions to which will be self-evident.

The repair of the majority of fistulæ of the genito-urinary tract will, therefore, be found under the operations upon the organs treated of, in the present work, as more largely the genital organs of the two sexes.

Operation for the repair of a simple vesical fistula – a typical example being such a fistula as follows the non-closure of a suprapubic cystostomy wound – will be found described under the operation of suprapubic cystostomy, p. 525.

OPERATIONS FOR DIVERTICULA OF THE BLADDER

Description.—The etiology of diverticulations and sacculations of the bladder has not been definitely settled – some holding that the condition is always congenital – others, that it is always acquired. Apparently, the majority conclude that diverticula of congenital origin contain one or all of the muscular coats of the bladder – while acquired diverticula are the result of bulgings of vesical mucosa and submucosa between the interlacing muscle bundles of the vesical wall, and contain no muscle-fibers. And both of these forms of diverticula are considered distinct from the congenital malformations of the bladder, characterized by the presence of two vesical chambers, separated from each other by either a vertical or transverse partition, and each having a ureteral orifice.

Diverticula may be variously placed, though usually occurring upon the lateral walls of the bladder, or near or involving the ureteral orifices – and may be one or more in number – and from the size of a pea up to a tumor filling the pelvis.

Operation Upon Diverticulum of the Bladder by Excision of the Sac and Suture of its Mouth – Lower's Technic.—The bladder is exposed by Pfannenstiel's transversely curved incision, in the suprapubic region – followed by the vertical separation of the recti muscles in the median line, and their lateral retraction. The bladder, previously distended, is then opened in the median line – and the vesical opening of the diverticulum located. The next step is to convert the sacculation into a solid tumor, as it were, in order to define its contour – and this is accomplished by tightly packing its interior with narrow strips of gauze, from the vesical opening. After this the external outline of the tumor is recognizable during the subsequent manipulations – for the purpose of defining its position, and safeguarding the surrounding structures in the act of freeing the diverticulum, if adherent. Having accomplished this, the outer bladder wall is next freed down to the site of the diverticulum – and this is done extraperitoneally if possible – the possibility of doing so being largely dependent upon the portion of the bladder

wall occupied by the diverticulum, its adhesions to neighboring structures, and the like. In some cases it will be necessary to open the peritoneum — but when this is done and it is possible to suture it up, after freeing the diverticulum, it should be closed before going on with the excision of the sac. In other instances the operation, begun extraperitoneally, becomes a full intraperitoneal procedure. In any event before the operation is concluded every effort is made to shut off the general peritoneal cavity from the site of both the bladder wound made by excising the diverticulum as well as the bladder wound of approach.

When the neck of the diverticulum is isolated, and the surrounding structures protected, it is excised, by knife or scissors — after which the opening into the bladder, left by the excision, is sutured, from the outside, by a tier of non-penetrating sutures.

It is preferable to close, by suture, the median suprapubic cystotomy wound — and simply drain this wound down to the sutured bladder. In some instances, however, the bladder itself may have to be temporarily drained through the suprapubic opening — the rest of the wound being closed down to the drainage.

Other Forms of Operation for Vesical Diverticula.—Stretching of the vesical orifice of the diverticulum — Ligation of the neck of the diverticulum, followed by excision of the sac — Closure of the vesical orifice of the diverticulum by suture — Excision of the mucosa of the sac, followed by denudation and suture of the neck of the sac — Incision and suture of the septum between the diverticulum and the bladder, throwing the two cavities into one — Incision of a narrowed orifice connecting the sac with the bladder — Anastomosis between the general bladder cavity and the cavity of the diverticulum — Excision of a diverticular sac involving the ureteral orifice, followed by transplantation of the ureter into an adjacent part of the bladder — and the like. Excision of the sac, however, is the most radical, and usually the best method.

Kelly and Burnham suggest reaching the site of the diverticulum through one of the following routes: — either by median abdominal incision — paramedian, vertical incision, through one of the recti — or by the transversely curved, suprapubic incision of the superficial parts, followed by the median separation of the recti.

Owing to the irregularities of position and the likelihood of complicating adhesions often welding the structures together, each case must largely be dealt with upon its own merits as to details of approach and management of the sac.

A ureteral bougie in the ureter which may be involved in the sac is most helpful in safeguarding this important structure during operation.

Temporary bladder drainage by a retained urethral catheter is always indicated, following operation, to remove all intravesical tension upon sutures.

Sometimes it is indicated to make the operation transperitoneal from the first.

Any accompanying obstruction to urinary outlet, discovered during the course of the operation, should, of course, be removed — as such obstruction may have originated the formation of the sac — and will certainly help to maintain it.

Lower lays stress upon the feature of his technic, which provides for the guidance, during the act of freeing and excising the sac, which is derived by keeping the fingers of one hand within the bladder, with the tip of the first finger within the diverticular opening, and the thumb on the outside of the bladder, in contact with the neck of the sac.

Sometimes instead of conducting an extravesical or an intravesical operation by the extraperitoneal or intraperitoneal route alone, various combinations of these procedures may have to be adopted.

While extraperitoneal approaches will usually suffice for diverticula of the anterior and lateral walls of the bladder, the peritoneal cavity will often have to be invaded for those upon the posterior wall.

Sometimes a sac upon the posterior wall can be operated upon by Von Dam's method – which consists in exposing the mouth of the sac through a transvesical route, and then inverting the sac into the bladder, after which it is amputated at its neck, and the margins of the resulting incision sutured. To accomplish the inversion it may be necessary to open the peritoneum.

OPERATIONS FOR EXSTROPHY OF THE BLADDER, IN GENERAL

Exstrophy of the Bladder, or Ectopia Vesicæ, is a developmental defect in the lower, anterior abdominal wall, in which the normal bladder is absent; the symphysis pubis is absent; the vesical mucosa bulges, or herniates forward; the pubic rami fail to come together and stand apart connected by a fibrous band; the ureteral orifices lie uncovered in the field, emitting urine intermittently; the anterior abdominal wall failing to coalesce in the suprapubic region, just as there is failure of median union in cleft-palate, harelip, and in spina bifida.

In the male the upper covering of the urethra is absent, the uretheral canal lying wide open; the penis is usually short, stumpy, and deformed; and the prepuce is generally redundant, hanging below the penis, apron fashion.

In the female both clitoris and nymphæ are bifid – the two halves standing well apart.

In both sexes sexual desire is usually not interfered with – sexual intercourse and ability to beget offspring depending upon the degree of deformity in the individual case.

Other accompanying deformities sometimes coexist – such as herniæ and prolapsus recti.

Operative Measures for Exstrophy of the Bladder.—Very many different procedures have been resorted to for the amelioration, and for the cure of this distressing, complicated, and difficult condition – with, unfortunately, results very unsatisfying to patient and Surgeon – as might be expected where the underlying fundamental difficulties are of the nature and degree here present.

All operative methods, thus far evolved, group themselves under two main headings: – Plastic procedures for the reconstruction of the bladder, – Implantation of the ureters into the intestinal tract, or upon the skin surface. And under each of these two methods of operating, for the main deformities as well as for the secondary deformities very many different technical procedures have been evolved – a few of the more generally employed ones of which will be here described.

OPERATION FOR EXSTROPHY OF THE BLADDER BY MOBILIZATION AND INVERSION OF THE VESICAL MUCOSA

SCHMIDT'S TECHNIC

In this procedure, which may sometimes be carried out in the less extensive types of ectopia vesica, the margins of the vesical mucosa are incised, and the peripheral flap mobilized in the connective-tissue plane. The incision circumvents the bladder everywhere except at its upper part, where provision is made for a temporary vesical safety drain against intravesical pressure, which might jeopardize the technic. The circumventing incision traverses the sound tissue just outside of the outline of the mucosa. Mobilization

is then accomplished in two directions: – the margins of the bladder are freed preparatory to inversion (Fig. 4774, **a**) – and the circumferentially outlying tissues are freed in the fascial plane for the purpose of roofing over the inverted bladder margins (v. Fig. 4774, **c**).

The inverted margins of the bladder are sutured together with chromic catgut sutures (Fig. 4775, **a, a**) which do not penetrate the mucosa, but take as firm a hold as possible upon the submucosal chorionic layer – to avoid capillary drainage from the septic bladder.

The tying of the first tier of sutures roof over the bladder in the manner shown in Fig. 4776. After this tier of sutures has been tied the outlying tier



Fig. 4774.—Operation for a Simple Type of Exstrophy of the Bladder – I: – **a,** Mobilization of part of the periphery of the exstrophied bladder; – **b,** portion of the periphery not mobilized; – **c,** mobilization of the adjacent outlying skin; – **d,** rudimentary vagina; – **e, e,** rudimentary labia minora (in the upper end of each is represented half of the clitoris); – **f, f,** labia majora. (Figs. 4774–4776 modified from Kelly and Burnham.)

which approximates the margins of the overlying skin-flaps, is then tied (v. Fig. 4775, **b, b** and Fig. 4776, **b, b**).

Upon the completion of the suturing a temporary fistulous opening is left at the upper aspect of the sutured wound (v. Fig. 4776, **c**), which prevents any tension upon the important sutures during union, from accumulation of urine in the still septic bladder. When union has occurred in the rest of the wound, this fistulous opening is operated upon at a later date.

In this, as in most operations for exstrophy of the bladder, a series of operations may have to be performed – in connection not only with the bladder itself, but in connection with the ureters and urethra – all dependent upon the degree and nature of deformity in the individual case.

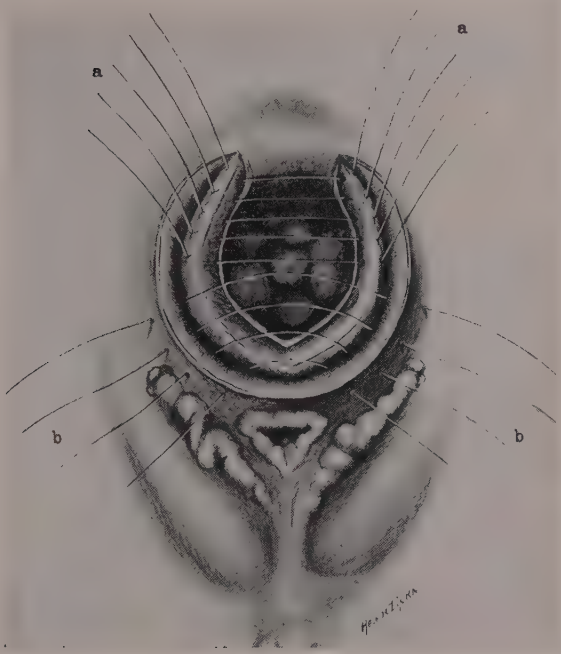


Fig. 4775.—The Same—II: —a, a, Non-penetrating sutures of the mobilized bladder wall passing completely around (though only represented above) the horseshoe opening, infolding the mobilized bladder upon itself; —b, b, skin sutures of the entire horseshoe opening (though only represented below) drawing the margins of the mobilized skin over the raw surfaces of the approximated bladder flap.

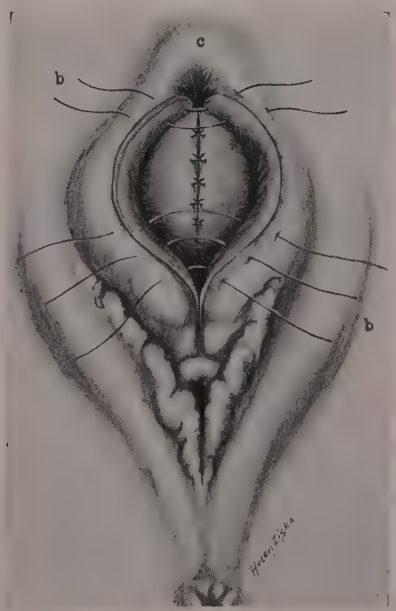


Fig. 4776.—The Same—III: —a, Tier of sutures infolding the mobilized bladder wall, seen in the center; —b, b, sutures approximating the mobilized skin over the sutured bladder; —c, portion of the undenuded rim of the exstrophy, left as a temporary drainage fistula, for safety.

OPERATION FOR EXSTROPHY OF THE BLADDER AND ASSOCIATED EPISPADIAS BY MOBILIZATION AND INVERSION OF THE BLADDER AND UTILIZATION OF THE PREPUCE

SEGOND'S TECHNIC

The bladder is freed around its upper and lateral aspects by an encircling incision carried through the junction of skin and mucosa – the mobilization being carried on in the fascial plane (Fig. 4777). The margins of the epispadias are freshened continuously with the lower ends of the encircling, mobilizing incision.

The mobilized upper portion and lateral borders of the bladder are now bent forward and downward, with raw surface outward, and their freshened borders are sutured to the freshened incisions extending from the lower ends

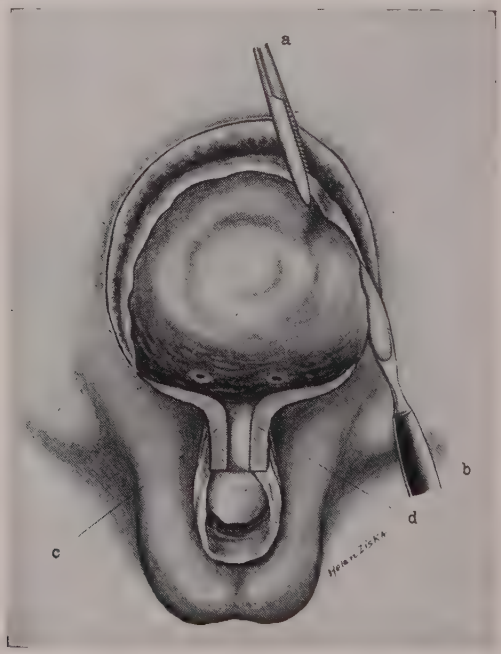


Fig. 4777.—SEGOND'S OPERATION FOR EXSTROPHY OF THE BLADDER – I: – **a, b,** Freeing the bladder from its bed, preparatorily to folding it over its ureters; – **c, d,** the freshened margins of the epispadias. The pubes are ununited, as shown. (Figs. 4777–4779 modified from Legueu.)

of the encircling incision through which the bladder is mobilized, to and including the freshened borders along both margins of the epispadiac furrow (Fig. 4778). A transversely curved incision is next made through the redundant prepuce, while it is held under slight tension – the incision being made immediately opposite the free tip of the glans (v. Fig. 4778, **b** to **c**). A blunt dissector or Mayo scissors are then made to divide the fascia between the mucosal and cutaneous aspects of the free portion of the prepuce, from the buttonhole to the free margin of the prepuce – after which the mucosal aspect of the prepuce is incised on both sides, from **b** to **d**, and from **c** to **e**. This maneuver will, when the preputial flap is unfolded, give a flap of twice the size – extending from **b** to **c**, to the tips of the forceps (v. Fig. 4778).

The head of the penis is now passed through the buttonhole in the preputial flap, after which the preputial flap is stretched upward, by the two

forceps, until it covers the raw surface of the inverted bladder _ when its margins are sutured to the margins of the already sutured inverted bladder _ the sutures of the preputial flap covering in the catgut sutures of the vesical border (Fig. 4779). The margin of the buttonhole which is drawn over the head of the penis is sutured to the free end of the vesical flap.

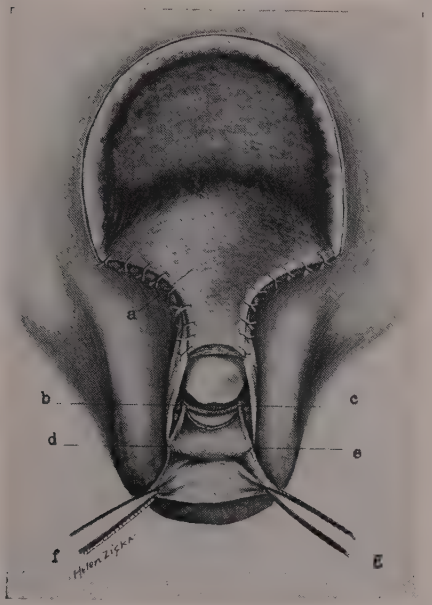


Fig. 4778.—The Same _ II: _ a, The partially detached bladder has been inverted and sutured along the freshened margins, with raw surface outward. The prepuce is buttonholed from b to c, and the mucosa is incised into the connective-tissue plane, from b to d, and from c to e _ after which the mucous flap, fg, is freed back, in the connective-tissue plane, to its hinge, d to e _ ready to be used.

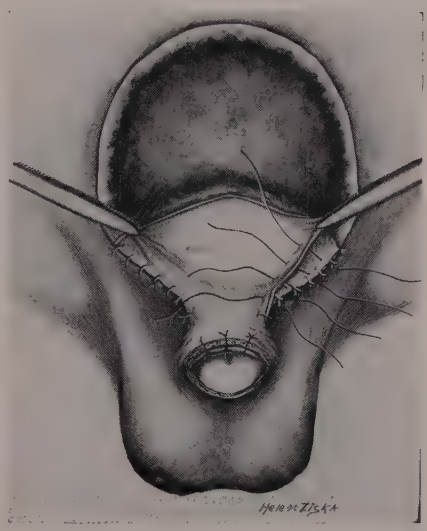


Fig. 4779.—The Same _ III; _ The buttonholed and split prepuce is drawn over the glans penis, and drawn as far up over the inverted bladder as it will reach _ where its raw surface is sutured to that of the inverted bladder along its upper convexity, and along its two sides. The margin of the inverted bladder and the skin aspect of the prepuce flap are stitched above the glans.

Finally, the skin surrounding the circular area of denudation is mobilized in the connective-tissue plane _ and its margins approximated, as nearly as possible, by suture, to meet each other, and to meet the free portion of preputial flap _ whatever gaps may result being covered by grafts.

OPERATION FOR EXSTROPHY OF THE BLADDER BY TUBULARIZED IMPLANTATION OF THE DETACHED URETERS IN THE SIGMOID

C. H. MAYO'S TECHNIC

Description.—The two features which characterize this procedure are _ the imitation of the common urinofecal, cloacal outlet of birds, _ and the adoption of nature's indirection method of conducting a duct obliquely through some distance of the wall of the viscus into which it enters, so that distention of the receiving viscus closes the duct against ascending infection.

This is a modification of the method frequently adopted, in transplanting the ureters into the sigmoid for other purposes _ and has been successfully applied in a number of cases.

Operative Technic of Ureteral Transplantation.—The salient features

of the operation as well as the principles upon which it rests will be summarized from the writings given in The Collected Papers of the Mayo Clinic, 1917, in which these features are described.

The fundamental features of the successful anastomosis of the ureters into the large intestine consist in tubularizing the ureteral entrance, in the wall of the bowel, for $1\frac{1}{4}$ inch. This may be accomplished either by Stiles' or, preferably, by Coffey's method, originally developed for anastomosing the common bile-duct with the duodenum. To accomplish this, the peritoneal and muscular coats, in the longitudinal band of the sigmoid, are incised axially for $1\frac{1}{4}$ to $1\frac{1}{2}$ inches, down to but not through the mucosa. The ureter is then exposed through an incision in the peritoneum, in the posterior pelvic wall, after which it is freed to within 1 or $1\frac{1}{2}$ inches of the bladder, and is there divided, and its distal end ligated. From $2\frac{1}{2}$ to 3 inches of the ureter are mobilized, the posterior peritoneum being sutured where it emerges. The free, proximal end of the ureter is then split for its terminal $\frac{1}{4}$ inch, and a piece of chromic catgut is carried through the end, tied, and one end cut short – the other being left as a tractor.

The sigmoid is then clamped with curved, rubber-covered clamps, in such manner as to surround the site of anastomosis. The mucosa of the sigmoid is then opened by stab incision, the incision being carefully made at its lower end. The curved needle, still threaded upon the catgut, is passed through the stab incision made into the sigmoid – and out through the full thickness of the bowel, at a distance of $\frac{1}{2}$ inch below the end of the incision – where the needle is made to pass through the peritoneum and muscularis, in order to hold the ureter in position. The margins of the incision in the wall of the sigmoid are then sutured together over the ureter, two or three of the sutures passing through the outer coats of the ureter, to further anchor it. The first row of suturing is reinforced by a second tier – which also buries in the knot that fixes the end of the ureter. The end of the ureter is thus obliquely buried in the wall of the sigmoid, in the same manner a duct would enter it, and over a considerable length of passage through the wall of the bowel – so that pressure from within the intestine will close the ureter – but will not interfere with the normal intermittent, automatic, contractile waves of the ureter, by which the urine is emptied.

As the urine is absorbed from the large intestine as the Murphy drip is, it is best to operate first upon one ureter and later upon the other – to give time for the establishment of tolerance of the uremic phenomena, the mental sluggishness usually passing within a week.

The abdominal incision is a low lateral one, made in the pelvic region. It is best to do the first operation upon the right side, which will always make the reaching of the sigmoid from the right side possible – for as the sigmoid passes to the left, it can always be reached from the left incision. If the left ureter were first operated upon, adhesions might make the later manipulations upon the right side more difficult. The second ureter should be transplanted about two weeks after the first operation.

A rectal tube may be kept in position for the first few days, during the establishment of the new function of the rectum.

The anastomosis should be made upon the left side of the colon – as the right side is the one from which absorption mainly takes place, which occurs chiefly by osmosis, via the portal circulation (rather than by the lymphatics). The lower end of the large intestine, therefore, is the site at which the ureteral anastomosis should be made.

The retention of the innervation of the ureters is essential.

OPERATION FOR EXSTROPHY OF THE BLADDER BY TRANSPLANTATION OF THE TRIGONE OF THE BLADDER, TOGETHER WITH ITS URETERAL ORIFICES, INTO THE SIGMOID

MAYDL'S TECHNIC

In this method of operating the vesical openings of the ureters, together with the adjacent trigonal portion of the bladder, are transplanted, *en masse*, into the sigmoid colon.



Fig. 4780.—MAYDL'S OPERATION FOR EXSTROPHY OF THE BLADDER _ I: _ a, a, Catheters (corked, to avoid soiling the wound) passed into the ureters to define their course; _ b, scissors in the act of severing the bladder from its bed; _ c, fingers displacing the severed bladder forward; _ d, peritoneum of the abdominal parietes; _ e, ureteral flap to be preserved (which would be better oval). (Figs. 4780–4782 modfied from Legueu.)

Both ureteral orifices of the deformed bladder are catheterized, and the mouths of the ureters corked. The abdomen is opened at the junction of skin and vesical mucosa, at the upper part of the vesical defect _ and through this opening two or three fingers of the left hand are inserted into the peritoneal cavity, where they serve as a guide during the continuation of the incision through the margin of the bladder throughout the circumference of the defect, as far as the epispadiac furrow of the penis, thus separating the bladder from the abdominal wall (Fig. 4780).

The bladder is then cut from the urethra _ being careful not to injure the

vagina, in the female – and dividing the urethra above the openings of the ejaculatory ducts, in the male.

The lower aspects of the ureters are carefully mobilized in their course through the pelvis, with careful preservation of their blood-supply. The excess of bladder wall is cut away from the ureteral orifices, leaving them opening upon an island of bladder tissue, of oval outline, the axis of the oval usually being transverse, though sometimes vertical. The transverse oval is preferable to the rectangular piece of tissue shown in the illustration. In planning this oval transplant the contour of the oval of serosa is calculated to be somewhat larger than the oval of muscosa, in order that a collaret of serosa, as Legueu terms it, may be formed, for the purpose of peritonizing the suture line.

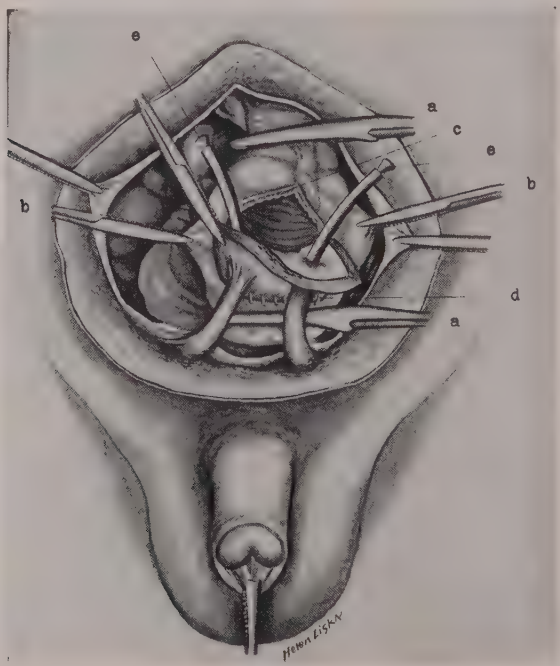


Fig. 4781.—The Same – II: – **a, a,** The sigmoid, clamped above and below the site of grafting; – **b, b,** clamps retracting the lateral aspects of the sigmoid; – **c,** incised sigmoid ready to receive the ureteral graft; – **d,** row of sutures attaching lower border of graft to sigmoid; – **e, e,** the ureteral graft, with the corked catheters still *in situ*, being sutured into the sigmoid.

The abdominal section is continued as far upward, in the median line, as may be necessary, in order to expose the sigmoid colon – and, after pushing aside its contents, doubly clamp the limits of the bowel within which the implantation is to be made (Fig. 4781). The ureters are mobilized sufficiently to span the needed distance for the anastomosis – being especially careful, in the act, not to damage their nutrient vessels.

The ureterotrigonal transplant of the bladder, after the ureteral bougies are withdrawn, is now sutured into the margins of an axial incision made in the longitudinal band of the sigmoid colon – the mucous surface of the transplant corresponding with the mucous surface of the bowel, and the serosa of the transplant continuous with that of the sigmoid (Fig. 4782). The bowel, manipulated by the clamps, with the neighboring field protected by gauze, is brought forward into convenient position for the technic of anastomosis.

Two tiers of sutures are used. The first tier may include the mucosa and muscularis of transplant and of bowel _ and the second tier, the serosa and muscularis of both. Or the first tier may be of the mucosa and muscularis, and the second, be Lemberts of the serosa, dipping into the muscularis.

Finally, the abdominal wound is closed.

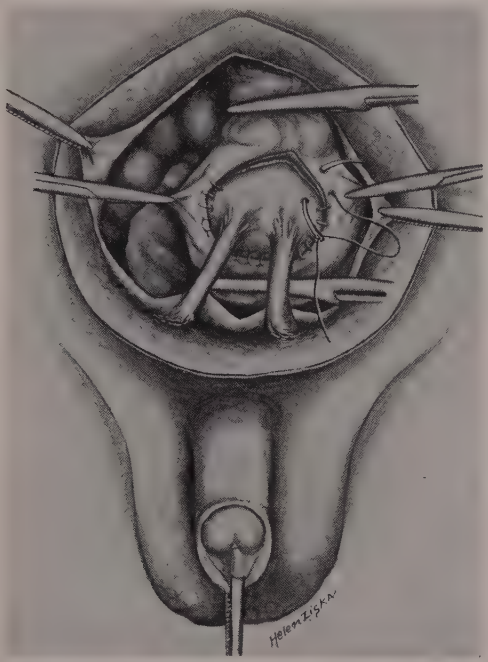


Fig. 4782.—The Same _ III; _ The corked catheters having been removed from the ureters, the suturing of the entire contour of the graft into the sigmoid is being completed.

In the act of closure Maydl fixed the loop of sigmoid to the abdominal wall _ in the event of complications.

OPERATION FOR EXSTROPHY OF THE BLADDER BY COMBINED OSTEOPLASTIC AND MYOPLASTIC REPAIR OF THE DEFECT

ALBARRAN'S MODIFICATION OF TRENDELENBURG'S TECHNIC

Albarran's application of the Trendelenburg technic is carried out in the following manner:

Corked ureteral catheters of size No. 7 are carried up the ureters for 15 cm. ($5\frac{14}{16}$ inches).

The left half-circumference of the bladder is surrounded by an incision placed at the junction of the skin and mucosa (Fig. 4783). The upper end of the incision is carried vertically upward, in the median line, sufficiently far for the subsequent exposure of the recti muscles, to below the umbilicus. The lower end of the incision is continued down the side of the deformed penis to the glans.

The skin and fascia are freed down to the left rectus muscle, down to the aponeurosis uniting the inner borders of the recti _ and, together with the aponeurosis of the rectus, retracted well to the left (Fig. 4784). The external surface of the left half of the bladder is dissected up, without opening the

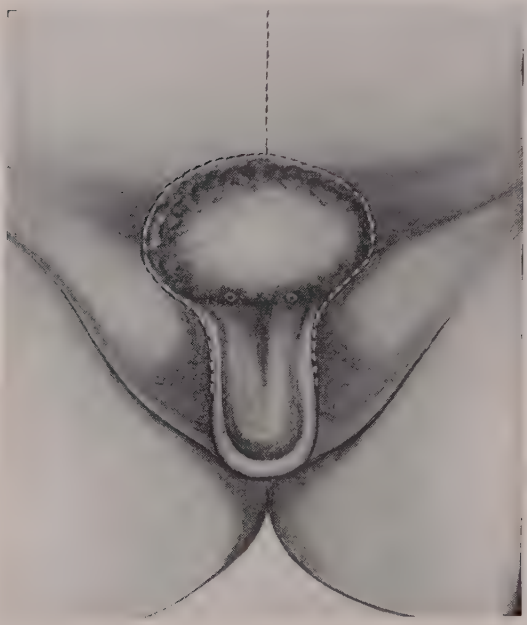


Fig. 4783.—Albarran's Modification of Trendelenburg's Operation for Exstrophy of the Bladder – I; – The incision, median above, encircles the exstrophy at the junction of skin and mucosa, and is prolonged along the sides of the penis to the glans. The median and left half of the incision are first made. (Figs. 4783–4788 modified from Albarran.)

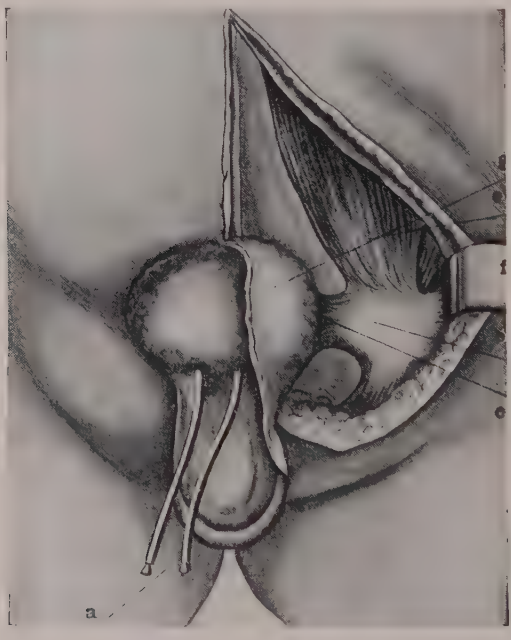


Fig. 4784.—The Same – II: – a, Corked ureteral catheters within the ureters; – b, inner end of undeveloped pubic bone; – c, fibrous tissue extending to opposite pubis; – e, rectus muscle; – f, outward retraction of margin of wound; – g, mobilized bladder and tissue of penis turned inward.

peritoneum, and turned mediad (v. Fig. 4784, g). The left border of the epispadiac groove is broadly freshened, taking care to leave a thick pad of connective tissue at the edge of the neck of the bladder.

Following the freeing of the left rectus muscle, the anterior surface of the left pubic bone is exposed _ its horizontal and descending rami and the fibrous band uniting the two bones (and replacing the symphysis pubis).

The interpubian fibrous band is divided at its osseous insertion. The horizontal and ascending rami of the pubic bone are divided, the two divisions taking place near to what would be the normal crest of the pubic bone (Fig. 4785). The partially detached fragment of bone receives the attachment of the left rectus muscle, but is separated from the insertion of the muscles of the thigh _ its posterior face remaining partially attached.



Fig. 4785.—The Same _ III: _ **a, a,** Folding toward the median line of the mobilized walls of the bladder and penis; _ dividing the horizontal ramus, **b,** and descending ramus, **c,** of the pubis. The interpubian fibrous band has been severed.

All of the steps above mentioned, in connection with the left side, are repeated upon the right side (Fig. 4786). The two lateral margins of the freed bladder, and the freshened margins of the epispadiac furrow, are now brought together in the median line, and sutured with fine chromic catgut stitches which do not penetrate the mucosa (v. Fig. 4785, **a, a** and Fig. 4787).

Finally, the detached portions of the pubic bones are drilled, brought together in the median line over the reconstructed bladder, and sutured in contact with kangaroo-tendon (Fig. 4787). If necessary, in order to accomplish this more satisfactorily, the outer borders of the recti muscles may be limitedly mobilized. The neighboring aponeurotic structures are sutured to the periosteum of the two partly detached pieces of bone, thereby steadying them in position.

The median borders of the recti are sutured together _ and over these

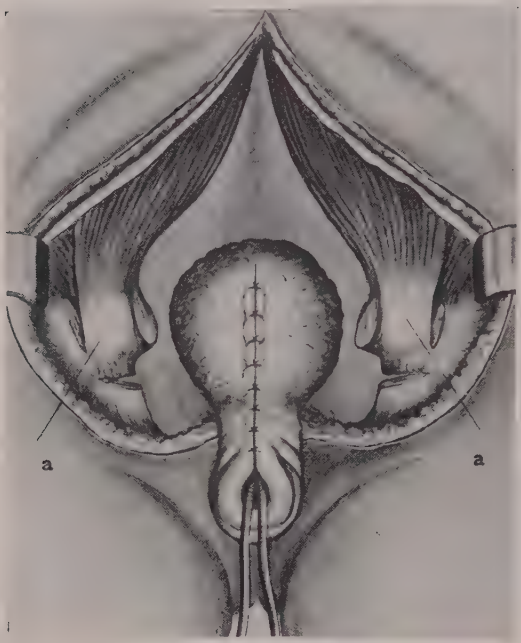


Fig. 4786.—The Same – IV; – The mobilized bladder and penile tissues have been sutured in the median line, restoring the roof of both organs: – a, a, The deformed inner aspects of the pubis have been mobilized through both horizontal and descending rami, and the interpubian fibrous band divided.

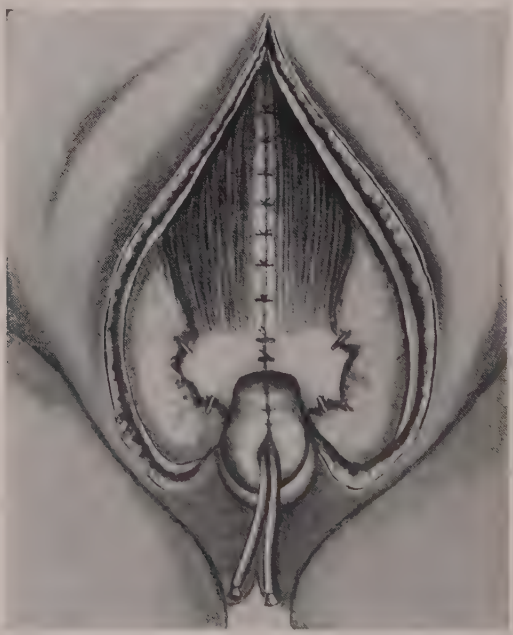


Fig. 4787.—The Same – V; – The freshened recti are united in the middle line – the drilled inner aspects of the pubis are sutured with wire or tendon – and the neighboring aponeuroses are sutured to the periosteum of the bones.

the margins of the aponeuroses are brought together — and then the fascia and skin. The lateral continuations of the wound are also sutured. Two rubber drains are inserted into the wound, near the base of the penis, passing

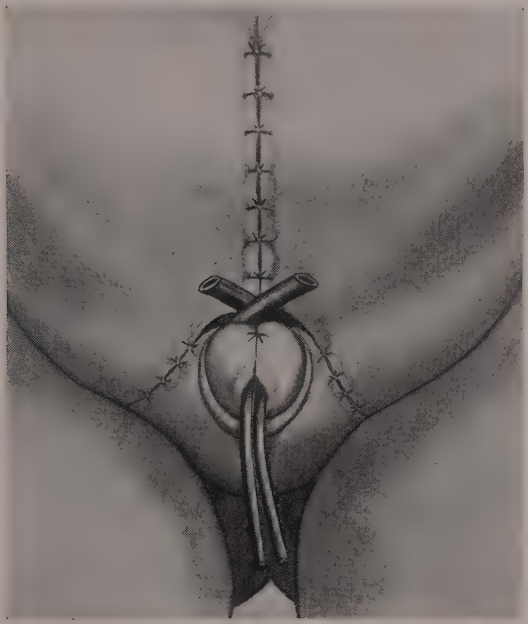


Fig. 4788.—The Same — VI; — The median and lateral wounds are closed — drainage established — and the corks removed from the temporarily retained ureteral catheters.

down to the sutured bladder, and emerging in the middle line. The corks are removed from the ureteral catheters, which are left *in situ* for a time. The completed operation is seen in Fig. 4788.

PARTIAL AND TOTAL CYSTECTOMY, IN GENERAL

The bladder is usually removed, in whole, or in part, for such conditions as tumors, tuberculosis, fistulæ, injuries, and the like. In proportion as an involvement is circumscribed and innocent, a partial removal may suffice — while extensive, diffused, or malignant involvements often call for the entire removal of the organ, in cases where so serious an operatin is not contraindicated by the patient's condition — and where, in the case of malignancy, metastases are not present.

General Features of Partial Cystectomy for Vescial Tumors.—The details of exposure of the site of operation will be determined by the features of the individual case — and by previous cystoscopy, in those cases in which the latter will throw any light upon the condition. The Trendelenburg position and median suprapubic cystotomy are the methods of procedure in the majority of cases. It is desirable that the intestines should fall away from the region of the bladder — so that the region will be less encumbered. The incised bladder, where incision precedes partial excision, is sometimes best exposed by thread tractors, sometimes by automatic retractors, sometimes by manual retractors. They should give the maximum intravesical room for work. Provision for satisfactory intravesical illumination should be made in advance — either by direct headlight, reflected light, or intravesical lamp.

The pedicles of excised tumors which cannot be conveniently sutured are sometimes seared with the actual cautery. Sometimes the pedicle of a tumor may have to be clamped, and the clamp left *in situ* for a day or two.

Malignant growths call for an especially wide removal.

Douching with hot boric solution will often control bleeding – as may gauze pressure – or local application of adrenalin solution.

When the tumor is approached from the outside, and occupies a portion of the bladder wall covered by peritoneum, if the situation be such as to render the technic possible, the peritoneum should be temporarily pushed back from the site involved – so that the operation may be conducted extraperitoneally. The peritoneum can often be pushed off up to the apex of the bladder and beyond, and from a part of the lateral walls.

Where the tumor is situated upon the anterior vesical wall, this wall must be freed from the posterior surface of the symphysis pubis – or symphysiotomy, or temporary symphyseal resection may be indicated.

Where the tumor involves the superior or upper posterior wall of the bladder, an attempt is still made to first strip the peritoneum from the site – failing in which, the peritoneum is incised. It will sometimes be found that it is possible, after the peritoneum has been opened, to cut through the peritoneum, around the margins of its adhesion to the vesical tumor – suture up the peritoneum, thus shutting off the peritoneal cavity – and then go on with the operation upon the bladder as an extraperitoneal procedure.

When the growth is upon the posterior surface of the bladder, lower down, the bladder is first incised in the median line, near its apex, and then the peritoneum is incised – and, if possible, cut from the bladder and closed – before going ahead with the operation upon the tumor.

If the tumor be above the ureters, upon the posterior aspect of the bladder, it may sometimes be exposed through a high suprapubic cystotomy and removed from within the bladder, followed by the approximation and suturing of the edges of the wound left, and the establishment of drainage.

If the involvement be at the mouth of a ureter, the site should be excised, and the healthy ureter, after excision of its vesical end, should be implanted within the same wound, in the act of its closure, if possible – or be transplanted into some adjacent proximal part of the bladder (ureterocystostomy – v. p. 457), after closure of the wound made by the removal of the tumor.

Where the tumor involves the base of the bladder, or immediately contiguous parts, one must often decide between a total cystectomy, with transplantation of the isolated and connected ureteral orifices into the rectum, on the one hand, or upon the undertaking of a more or less extensive partial cystectomy – and the circumstances of the individual case will be the only guide.

Sometimes a transverse cystotomy will best expose the site of operation.

In all cases of partial excision of the bladder temporary drainage should be provided for in a twofold manner, – by catheter, through the urethra, and down to the sutured wall of the bladder – for the prevention of overdistention of the bladder and tension upon the sutures. Sometimes it is well to leave the bladder wound partly open for a time.

General Features of Total Cystectomy.—The decision to remove the entire bladder should be reached only after mature deliberation – and in connection with its performance several considerations enter.

The removal of a portion, rather than all of the bladder should be undertaken, when a partial cystectomy will suffice – as it is estimated that the morality is about three times greater in total than in partial cystectomy.

The necessity for making provision for the urinary flow, in the case of

sacrificing the bladder, is always present — and is a major part of the operative problem. The best policy seems to be to make the ureteral implantation as a preliminary operation, several weeks in advance of the excision of the kidney — thereby lessening the shock and the length of the main operation. The danger of ascending infection of the ureters, chiefly from stenosis of the outlet, is to be faced, in no matter what way the ureteral part of the problem be settled.

The ureters have been implanted into the rectum, into the sigmoid, into the suprapubic wound, into the vagina, into the urethra, and into the loin.

To summarize — probably the weight of surgical opinion is to bring about the derivation of the urine as a preliminary operation several weeks in advance of the main operation at which the bladder is excised — and of the various forms of implantation, probably the most satisfactory is that suggested by Watson (v. p. 604), where he performs what he terms bilateral lumbar nephrostomy, in which he anchors, in the lumbar regions, both ureters divided near their junction with the pelves of the kidneys.

If ureteral derivation and cystectomy are performed at different operations, the best procedure in the male is double lumbar nephrostomy, or ureterostomy — and, in the female, either of these, or vaginal implantation, — and if both operations be performed at one time, the best ureteral implantation, in the female, is vaginal — Walker.

If the seminal vesicles and prostate gland are not involved, it seems to be agreed that they need not be, and, by some, should not be removed. On the other hand, the simultaneous removal of the bladder and prostate by the combined abdominoperineal routes is reported as not being more difficult, or more serious in fatality, than the removal of the bladder alone — so that if, in addition to the bladder problem, there be any prostatic involvement, which is often the case, the double operation of cystoprostatectomy should be performed.

PARTIAL CYSTECTOMY

Description.—Removal of a limited portion of the bladder, followed by restoration of the remainder. The operation is usually performed for tumor involving the bladder wall limitedly — sometimes for traumatism. The tumor may involve but a superficial part of the inner or outer wall of the bladder, or its entire thickness — and the site of the tumor may be extraperitoneal or intraperitoneal, or both.

Owing to the various aspects of the bladder which may be involved in partial excisions of the organ, various modifications of technic are employed — the chief of which will be here considered.

Preparation — Position — Landmarks.—As for median suprapubic cystotomy, as a rule (v. p. 525).

Incision — Operation.—These will be modified by the special features of the case.

(*a*) Excision of Tumors Involving the Outer Wall of the Bladder: These usually involve the entire thickness of the bladder wall, so that their removal also involves the excision of some part of the entire thickness of the wall of the bladder (v. i.).

(*b*) Excision of Intravesical Tumors Involving Part of the Thickness of the Vesical Wall: The situation and nature of the tumor or tumors within the bladder should be determined by cystoscopic examination, in advance of any operative procedure — and a mental picture made of their situation and features before the bladder is opened. The usual method of treating non-malignant, pedunculated tumors of this class is to surround their pedicle,

including the immediately adjacent vesical mucosa, by an elliptic incision which passes into the submucosa, but not through the bladder wall – the incision being made while the neighboring parts, or tumor, is steadied by forceps. The margins of the bed left by this excision are then brought together by fine chromic catgut. Instead of making the elliptic excision by knife cut, the base of the pedunculated tumor may be seized with special, curved forceps, elevation of which will lift the clamped tumor somewhat from its bed and, while thus held, curved scissors are passed beneath the clamp and the tumor excised (Fig. 4789, **a** and **b**). The resulting wound does not pass entirely through the wall of the bladder – and its margins are brought together by fine catgut suturing (v. Fig. 4789, **c**). Sometimes when several closely

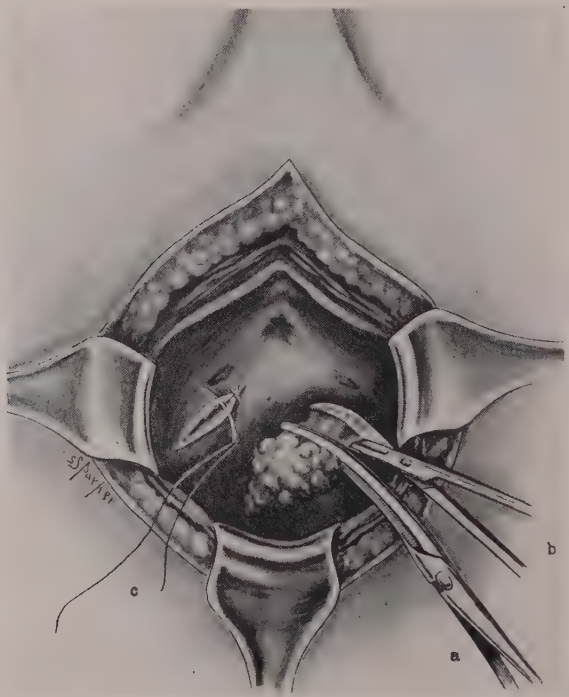


Fig. 4789.—Excision of a Pedunculated Papilloma of the Bladder: – **a**, Forceps drawing the tumor outward, putting the pedicle upon the stretch; – **b**, scissors dividing the base of the pedicle; – **c**, suturing the bed of such an excised tumor.

placed papillomata occupy a limited tract of mucosa, they may, in appropriate cases, be excised by the removal of a shallow elliptic strip of mucosa and submocosa – followed by the suturing together of the margins of the bed.

Pedunculated intravesical tumors are sometimes removable by the actual cautery. The tumor is exposed – its base clamped with curved forceps, between which and the bladder wall wet boric acid gauze is placed (to neutralize the heat of the cautery) – after which, while gentle traction is practised upon the tumor, the actual cautery cuts through its pedicle immediately above the clamp (Fig. 4790).

Pedunculated tumors within the bladder are sometimes removed by combined cutting and crushing forceps – some of the instruments being so constructed as to carry their own illumination with them (Fig. 4791).

(*c*) Excision of Intravesical Tumors Involving the Entire Thickness of the Bladder Wall: The procedure is here the same in principle as in the excision of intravesical tumors involving part of the thickness of the vesical wall by elliptic incision _ except that the elliptic incision passes everywhere through the entire thickness of the wall of the bladder. It is desirable, if possible, to bring the tumor and its base sufficiently into the field for manipulation. This may generally be accomplished by placing two stay sutures passed through the inner coats of the bladder, just beyond the sites of the apices of the ellipse _ by gentle traction upon which the side of the tumor can usually be brought within the field of very much more convenient manipulation. The tumor is then outlined by knife carried through the sound mucosa just beyond its confines (Fig. 4792). This cut passes through the full thickness of the bladder wall at one of the apices of the incision _ after which the

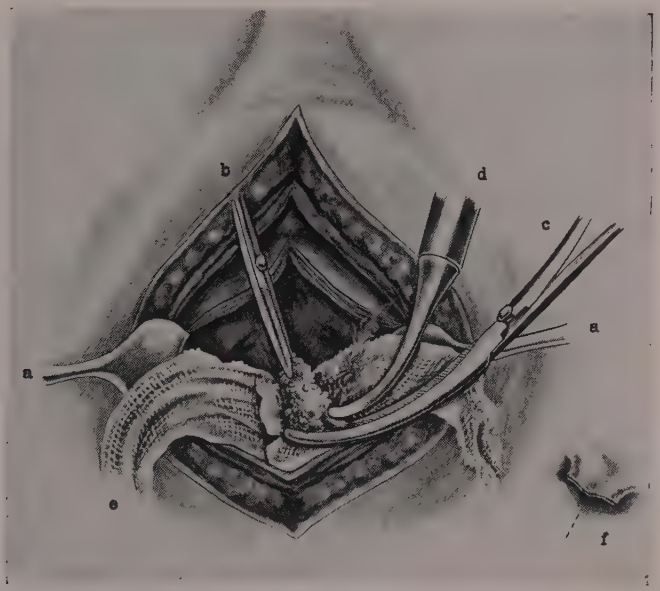


Fig. 4790.—Removal of Papilloma of Bladder by Actual Cautery: _ a, a, Retractors of the opened bladder; _ b, forceps, putting the base of the papilloma upon the stretch; _ c, clamp compressing its pedicle; _ d, cautery point severing the connection of the papilloma with the bladder; _ e, wet gauze protecting the bladder; _ f, the compressed, cauterized base.

bladder wall is cut through in the rest of the ellipse either by knife or by scissors _ using sharp-pointed angular or curved scissors, as indicated. Upon the removal of the growth and control of hemorrhage, the margins of the bladder wall are brought together by fine chromic catgut sutures, passing through the margins of all the coats of the incision. If, mechanically, one felt able to pass a first tier through only the outer coats, and a final tier through the inner coats, such technic would be more surgical _ but the difficulty of accomplishing this from the inside of the bladder must be great. Where the excision is made from the outside, it should be undertaken.

(*d*) Excision of an Intravesical Tumor Involving the Ureteral Orifice, with Re-establishment of the Ureter in the Same, or in an Adjacent Part of the Bladder Wall _ Legueu: In this procedure the bladder is opened and a ureteral bougie passed from within the bladder, through the bladder wound,

into the orifice of the ureter, and projected a short distance up its lumen. This is for the purpose of manipulation and control. An elliptic incision is then carried through the wall of the bladder, including the tumor and the vesical opening of the ureter, which the tumor involves _ forceps, the meantime, practising gently traction upon the tumor _ and the ureteral sound being kept in position. As soon as the bladder wall has been everywhere cut through and the tumor, its base and the beginning of the ureter isolated, a couple of temporary anchorage sutures are passed through the outer coats of the ureter, and through the margins of the bladder incision _ so that when the

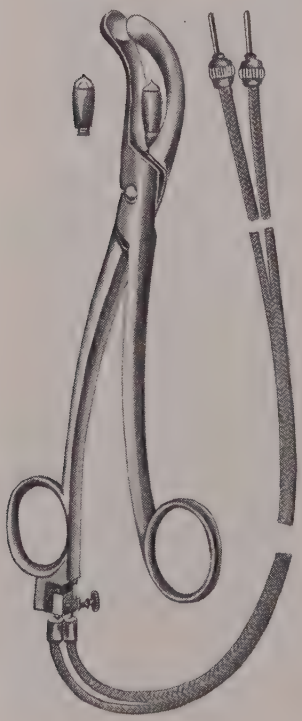


Fig. 4791.—Nitze Bladder Forceps with Electric Light.

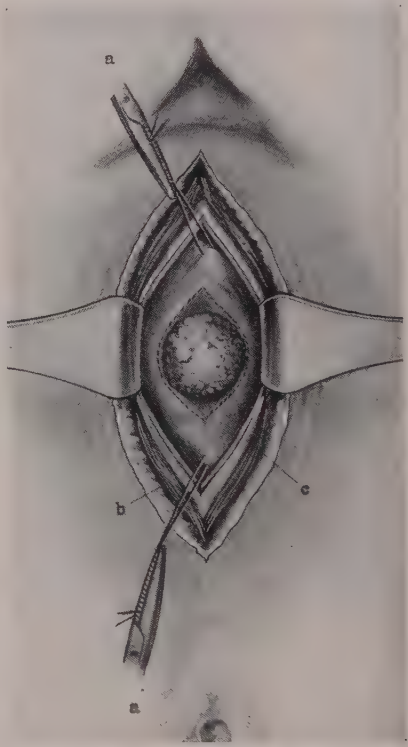


Fig. 4792.—Excision of Tumor of Floor of Bladder; _ The tumor and neighboring bladder wall are nearer into the field by means of two guy-stitches, a, a. An elliptic incision indicates the area of bladder wall to be removed with the tumor; _ c, the anterior bladder wall; _ b, the median margin of rectus muscle.

tumor and terminal end of the ureter are cut off the proximal portion of the ureter will not retract out of reach (Fig. 4793). The wound in the wall of the bladder is then brought together by fine chromic catgut sutures passing through all the coats _ and, at the middle of the incision, the excised end of the ureter is anchored by four catgut sutures, two on each side. If the circumstances of the excision are such as to make it impossible to re-anchor the new end of the ureter in exactly the same position as the old end occupied, then it may be anchored in the end of the incision nearer the kidney, or the incision may even be a little prolonged backward somewhat for that purpose.

(*e*) Excision, from Without, of a Tumor Involving the Full Thickness of the Bladder Wall, by Elliptic or Oval Incision: The outer aspect of the site of tumor is exposed by whatever technic may be indicated – the wall of the bladder steadied by lightly grasping clamps or by stay sutures – and the tumor, including the full thickness of bladder wall, excised by knife or by scissors (after the wall has been cut through), along an outline safely in sound tissue. The more nearly the outline of the incision conforms to an ellipse, the easier will it be to bring together the resulting bladder wall by

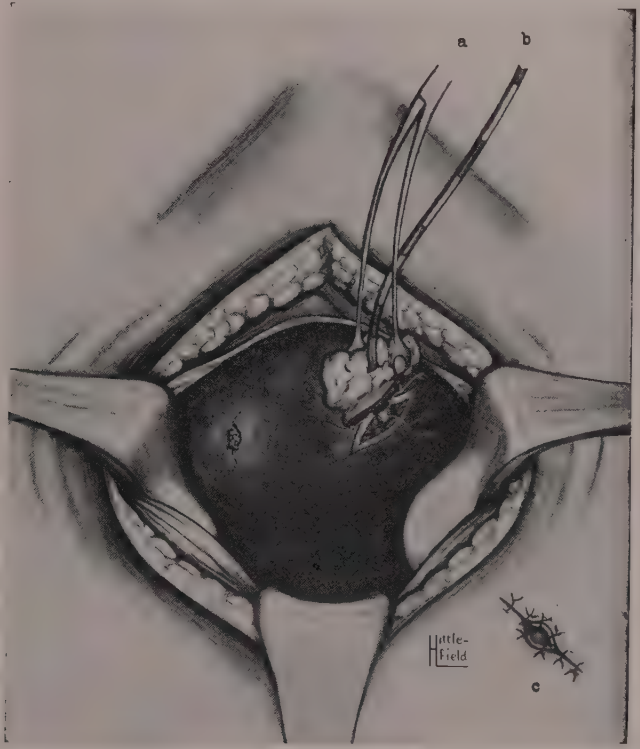


Fig. 4793.—Incising Adjacent Bladder Wall to Liberate a Semi-encysted Ureteral Calculus from the Left Ostium – Excising the Right Ureteral Orifice, Involved by Papilloma: **a**, A ureteral catheter, which has been passed after opening the bladder; – **b**, tenaculum forceps grasping the growth. Temporary anchorage sutures, passing through the outer coats of the ureter, are placed before dividing the ureter just proximal to its orifice, to hold the ureter within control. **c**, The right ureteral orifice sutured, with end of ureter anchored between the margins of the wound. (The axis of the incision should be the same as that of the sutured wound, **c** – and not shown at **a** and **b**, where the tumor would hide a properly placed incision.)

suture, following the excision. The removal of a tumor of the vesical wall, by oval incision, is shown in Fig. 4794. Finally, the bladder opening is closed by fine chromic catgut sutures which penetrate the outer coats, but do not enter the mucosa. The direction of the line of suture will usually be determined by the shape of the excision – conforming, as a rule, with the general axis of the bladder. Sometimes, when it would seem that the suturing of the wound in a certain axis would cause undue contraction in some part of the bladder, the wound may be sutured in the opposite direction – though the mechanical coapatation of an elliptic wound in this manner is more difficult

than in the case of a circular or oval wound. The principle of this reversal is seen in Fig. 4795.

(*f*) Excision, from Without, of a Tumor Involving the Full Thickness of the Bladder Wall by an Irregular Form of Incision: The shape or position, or both, of the tumor may determine the planning of other than a simply circumventing line of excision – an outline, in other words, which, while including the satisfactory removal of the tumor, will also provide the best means to bring together the resulting margins of the bladder. This is more apt to be the case in malignant tumors of the bladder, which may offer fair chance of saving the patient without total cystectomy, and in some wounds. In Fig. 4796 is seen the triangular excision of a tumor site, with the prolonga-

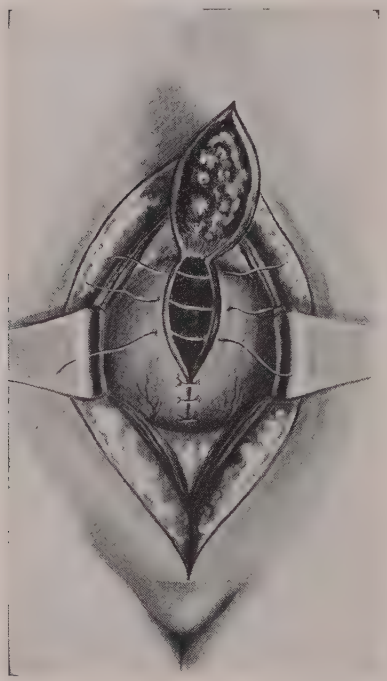


Fig. 4794.—Excision, from Without, of a Tumor of the Bladder Wall by Oval Incision; – Two stages of the operation are shown in the one picture – the act of excision – and the act of suturing.

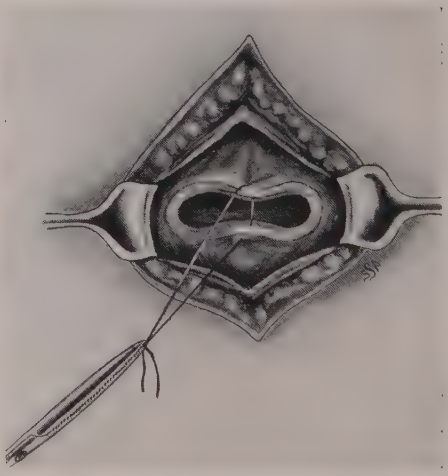


Fig. 4795.—The Transverse Closing of a Median Cystotomy Wound.

tion of one side of the triangle, in a curved direction – so that when the site is excised and the two shorter borders of the triangle are first sutured together, and then the long, unbroken side is sutured to the other side – by non-penetrating sutures (Fig. 4797).

The type of partial excision may be such as to leave very asymmetric borders to be sutured together – but which, nevertheless, may be brought together satisfactorily enough to hold urine, even though not resorting the original symmetry of the viscus. In Fig. 4798 the bladder has been opened by a median incision, after which the tumor and piece of the bladder wall of irregular outline has been excised – when the irregular opening will be closed by non-penetrating sutures.



Fig. 4796.—Partial Excision of the Bladder – I: – a, Forceps grasping the tumor-involved area of the bladder to be removed; – b, scissors excising the dotted area.



Fig. 4797.—The Same – II; – Suturing of the bladder wound by non-penetrating stitches.

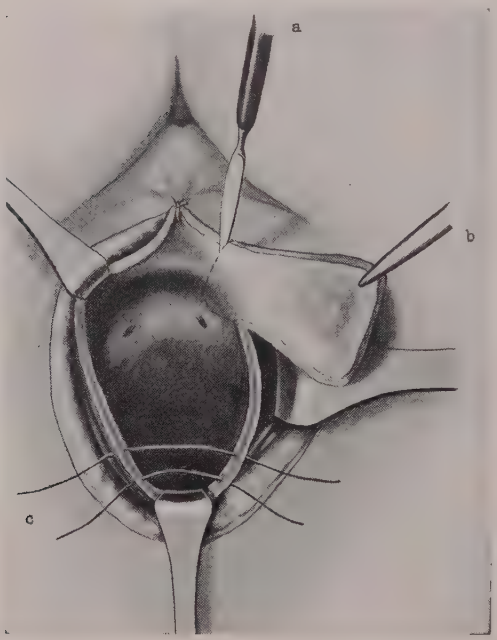


Fig. 4798.—Partial Excision of the Bladder; – The bladder has been exposed, and incised immediately adjacent to the tumor: – a, b, excision of the part of the bladder wall involved by the tumor; – c, non-penetrating sutures approximating the margins of the resulting bladder wound. The anchorage stitch to the skin is temporary.

TOTAL CYSTECTOMY IN THE MALE

BY SUPRAPUBIC EXTRAPERITONEAL ROUTE—WATSON

Description.—The complete removal of the bladder, extraperitoneally – preceded by the preliminary transplantation of the ureters.

In this technic both ureters are divided near the pelves of the kidneys and brought out in the lumbar region, at a preliminary operation – constituting bilateral lumbar nephrostomy. The purpose of this is twofold – first, for the same reason that preliminary lumbar colostomy is so often performed in advance of operating for cancer of the rectum – and because, second, death following total cystectomy occurs, in many cases, according to Watson, from infection of the kidneys from ureters, transplanted by other methods. Thus, too, the most difficult feature of the major operation, dealing with the ureters, is obviated at the time of the removal of the bladder.

The bladder is then exposed extraperitoneally, through the suprapubic route, and excised at its neck, together with the vesiculæ seminales and vasa deferentia – and, if necessary, the prostate gland.

Preliminary Operation – Simultaneously Performed Bilateral Nephrostomy.—The ureters are exposed high up, by lumbar incisions – divided near the pelves of the kidneys – and anchored in the lumbar wound, constituting permanent lumbar urinary fistulæ. This type of ureteral implantation, termed "bilateral lumbar nephrosty" by Watson, is preferred by him to any other form of ureteral implantation – especially as, in this case, the trigone of the bladder has also to be sacrificed, so that the normal vesical outlets of the ureters, with their safeguards against infection, cannot be transplanted, together with that portion of the base of the bladder, into the sigmoid. Albar-

ran and Watson and others observe the considerable less likelihood of kidney infection following nephrostomy and permanent kidney drainage (that is, very high lumbar ureterostomy), than infection following other ureteral implantations. They state that the kidney tissue, in the former, takes on a special immunity to infection.

Major Operation _ Total Cystectomy: _

Preparation.—The patient's general condition is gotten as satisfactory as possible. The bladder is well irrigated _ and about 8 ounces of sterile saline solution left in it. A curved metallic sound is passed into the bladder.

Position.—The patient is placed in a moderate type of Trendelenburg position.

Incision.—Either the median or transverse abdominal incision employed in suprapubic cystotomy is used (v. pp. 525 and 536).



Fig. 4799.—Total Extraperitoneal Excision of the Male Bladder _ Watson _ I; _ The bladder is exposed through Pfannenstiel's transversely curved, suprapubic incision: **a,** Retractors of the unopened peritoneum and peritoneally surrounded intestines; _ **b,** hand following down and separating the peritoneum from the posterior aspect of the bladder; _ **c,** vulsellum forceps drawing the bladder out of its bed.

Operation.—The anterior aspect of the bladder is exposed and the peritoneum is pushed backward from its upper and posterior surfaces by blunt dissection with the fingers (Fig. 4799). While the fingers are pressing the peritoneum from the top and back of the bladder, the apex of the bladder, held by clamps, is drawn forward, and displaced downward so as to emphasize the cleavage line between posterior bladder wall and peritoneum. This method of freeing the posterior wall of the bladder is continued until the vesical ends of the ureters are reached _ the upper ends of which have been tied off in the preliminary operation. The ureters are freed as high as possible and double ligatures carried around them with an aneurysm needle (Fig. 4800), after which they are divided between the ligatures.

Continue to draw the bladder forward toward the symphysis as far as possible, while freeing the rest of the peritoneum _ and separating the bladder

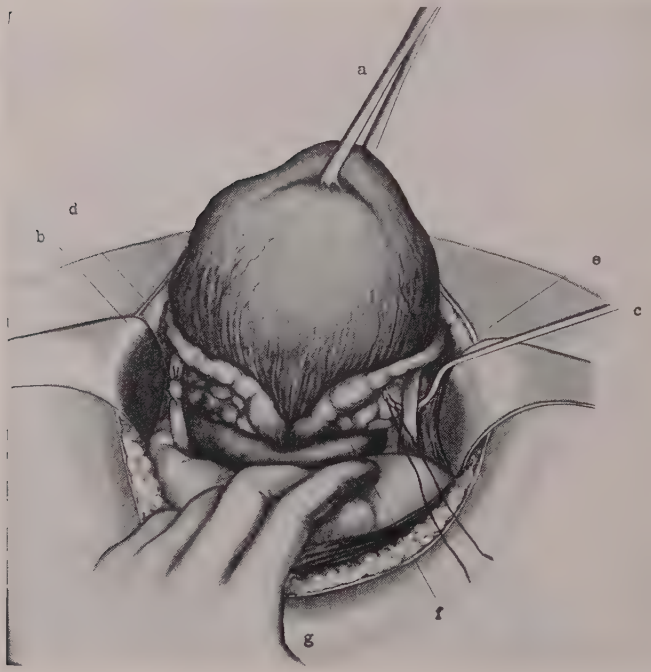


Fig. 4800.—The Same _ II: _ **a,** Tractor of the mobilized bladder; _ **c,** passage of double ligatures of the right ureter; _ **b,** the left ureter doubly ligated; _ **d,** vas deferens; _ **e,** vesicula seminalis; _ **f,** prostate gland; _ **g,** retracted peritoneum.

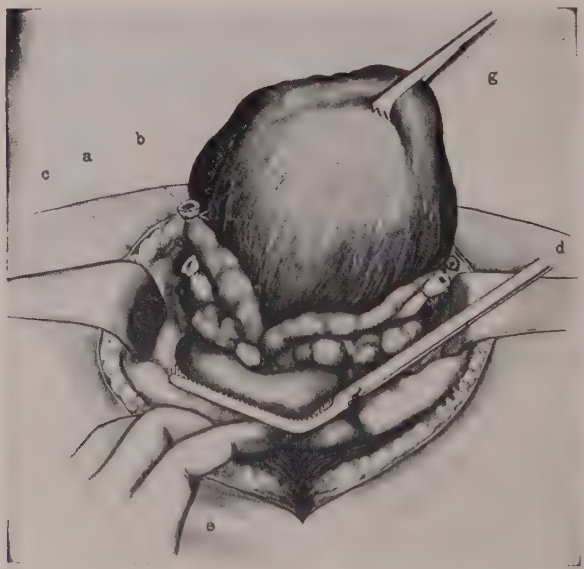


Fig. 4801.—The Same _ III: _ **a,** Ligated ureter; _ **b,** ligated vas deferens; _ **c,** vesicula seminalis; _ **d,** clamping the membranous urethra below the prostate gland; _ **e,** peritoneum retracted backward; _ **g,** bladder retracted forward. The prostate is, here, also being removed _ the ligatures passing through the preprostatic urethra.

in front, from the prostate, posteriorly (Fig. 4801). Pass a pair of angular clamps low down into the wound, and clamp and elevate the base of the bladder – and, while thus held, carry, upon a curved needle, in a holder (or by Reverdin needle) a double No. 2 chromicized catgut ligature through the middle of the posterior aspect of the lowest part of the neck of the bladder – and carry it forward until it emerges through the anterior wall of the neck of the bladder at the same level. The double ligature is cut, making two of it – after which cross the ligatures – and tie off each half of the neck of the bladder separately, including its vessels. The neck of the bladder is then divided transversely, just above the ligatures, and the whole of the bladder removed.

A counteropening is made in the middle line of the perineum, guided by a finger in the vesical wound – and through this a gauze drain is carried up to the unopened peritoneum – after which the abdominal wound is closed solidly throughout.

In those cases where either the prostate gland or the seminal vesicles, or both, are involved, they, too are excised – including the vasa deferentia, from the site of their ligature near the inguinal rings.

Where the prostate gland must be removed, instead of carrying the two ligatures through the neck of the bladder, as in a simple excision of the bladder alone, they are passed through the urethra in front of the prostate (that is, at the apex of the gland) – one-half of the crossed ligature tying off the structures and vessels upon one side, and the other upon the opposite.

TOTAL CYSTECTOMY IN THE MALE

BY COMBINED PERINEAL AND ABDOMINAL ROUTES

Description.—In advance of the major operation, as a preliminary step, operative provision is made for the diversion of the ureters by some one of the available methods.

At the time of the main operation the bladder is first freed from the rectum by the perineal route – and then excised by the suprapubic route – extraperitoneally, if possible.

Preparation.—The division and diversion of the ureters has been carried out several weeks in advance. Just before the operation the bladder is filled with 10 to 12 ounces of warm boric solution.

Perineal Stage of the Operation.—With the patient in the lithotomy position, a curved incision, with forward convexity, is made across the anterior perineum, between the anus and the prostate, as carried out in Zuckerkandl's prostatectomy. This is carried down through skin and fascia, and down through the structures between the urethra and rectum – until finally the space which is bounded by the deep urethra and prostate, in front, and the rectum, behind, is exposed – and opened up until the base of the bladder is exposed, and the peritoneum is pushed upward from the vesiculæ seminales.

Suprapubic Stage of the Operation.—With the patient in the Trendelenburg position the bladder is freely exposed by the technic carried out in the operation of transverse cystotomy (v. p. 536) – dividing skin and muscles in a transversely curved direction, the convexity of the cure being toward the pubis, and provision being made to control the retracting ends of the transversely divided recti. If considered better, instead of adopting the transversely curved incision, the reversed T-shaped incision may be used – the vertical portion of the incision being in the median line, and the transverse portion just above the symphysis pubis. Through whichever incision is adopted, the peritoneum is peeled away from the anterior, superior, posterior, and lateral surfaces of the bladder by blunt dissection with the finger-tips.

This separation of the peritoneum from the posterior surface of the bladder is continued on down from above until it reaches the region from which the peritoneum has been separated from the posterior surface of the bladder upward through the perineal wound. It is not to be expected that this separation will everywhere proceed with ease. At certain sites the peritoneum is apt to be found so adherent that it will be torn in the attempt to separate it _ and, when this occurs, the rent should be sutured, and the separation continued. At times it may be necessary to deliberately cut the peritoneum around regions of unusual adhesion _ but at the ends of such tears, or deliberate incisions, the continuity of the peritoneal margins are restored by suture _ and the operation continued extraperitoneally (Fig. 4802).

When the freeing of the bladder posteriorly, from above, has reached the level of the posterior freeing through the perineum, the pubovesical ligaments

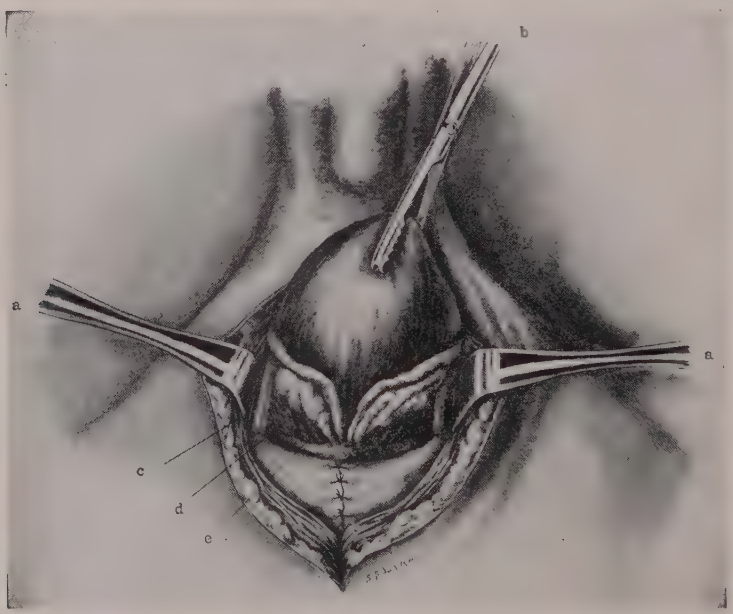


Fig. 4802.—The Same; _ The peritoneum, which has been accidentally torn during the operation, or purposely incised to secure freer exposure, is here shown restored by suture. **a, a,** Tractors of the wound; _ **b,** tractor of the bladder; _ **c,** ureter; _ **d,** vesicula seminalis;_ **e,** vas deferens.

are divided, thus separating the bladder from the symphysis pubis anteriorly _ and bleeding from the venous plexus here encountered controlled by gauze packing.

The vasa deferentia and the vesiculæ seminales are detached from the wall of the bladder and pushed out of the way.

The structures upon the right side of the bladder are freed while the bladder is being forcibly drawn to the left _ and those upon the left, while the bladder is displaced to the right. Each ureter in turn is isolated and doubly ligated near the bladder and divided between the ligatures (by the actual cautery in Albarran's technic). The vascular pedicles, upon the lateral and inferior aspects, are doubly tied and divided. Sometimes the vessels forming the vascular pedicles are seized with clamps, cut beyond the clamps, which temporarily are left in the wound _ and are tied later. All steps are duplicated upon the two sides.



Fig. 4803.—The Same _ III; _ The otherwise freed bladder is being drawn upward and backward, putting the structures of its neck upon the stretch, preparatorily to their division. The vessels of the lateral vascular pedicles are shown ligated.

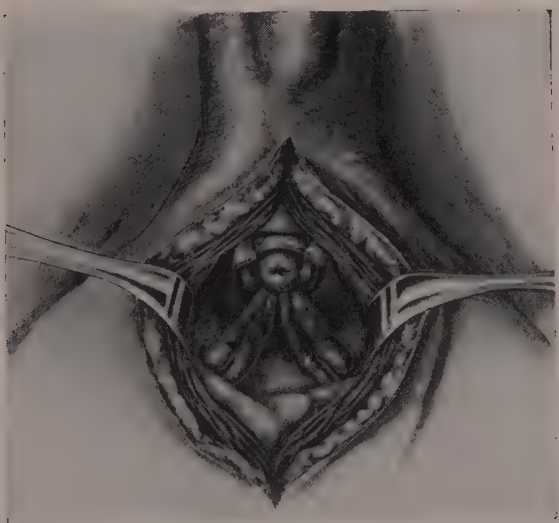


Fig. 4804.—The Same _ IV; _ The bladder has been entirely removed by the final division of its neck at the prostatic urethra. The prostate, vesiculæ seminales, vasa deferentia, and ligated vascular pedicles are seen in the field.

All is now ready for the division of the neck of the bladder. After emptying the bladder of its fluid, the neck of the organ is put upon the stretch in one of two ways: – the summit of the bladder may be seized with forceps and drawn upward and backward, thereby exposing the junction of the anterior aspect of the neck of the bladder and the prostate gland (Fig. 4803), – or, as Albarran advises, forceps may be introduced through the perineal wound and, seizing the bladder, draw it backward, as though to deliver it through the perineal wound – and while thus tensed, the neck of the bladder is divided, from before backward, at the site where it joins the prostatic urethra – the

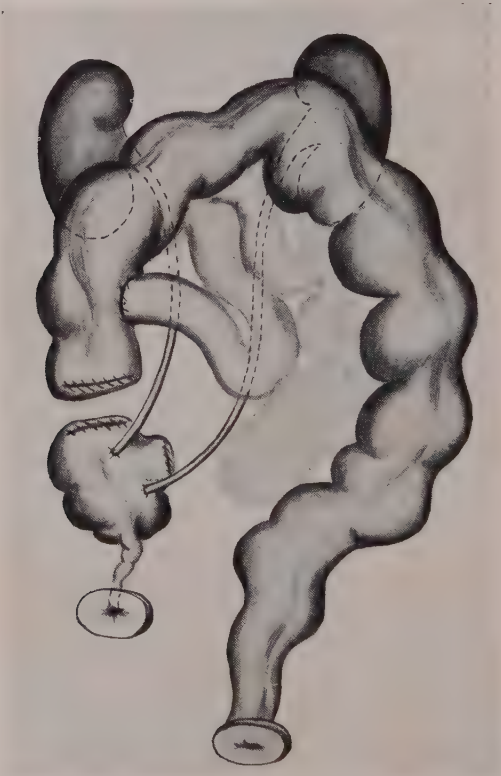


Fig. 4805.—Verhoogen's Operation for Utilizing the Cecum as a Bladder and the Vermiform Appendix as a Urethra; – Following excision of the bladder the cecum is separated from the ascending colon, and the cecal and colonic openings closed. The ileum is also separated from the cecum – the cecal end closed – and the proximal end anastomosed with the distal end of the colon, by end-in-side implantation. The end of the appendix is opened and anchored upon the skin.

section being made by cautery. The bladder opening is clamped with forceps. Finally, the vesical trigone is dissected from the upper aspect of the prostate gland by scissors – and the bladder removed (Fig. 4804). Every care is used to avoid infecting the wound, where the sections pass through the urinary tract. And every precaution is taken to control bleeding from the lateral vascular pedicles and from the venous plexuses – and if these were temporarily clamped, they are now securely tied, preferably each main vessel separately.

In concluding the operation a large rubber tube is placed in the perineal wound, the ends of which are sutured, up to the exit of the tube – and a second

large rubber tube in the lowest part of the suprapubic wound, behind the symphysis, passing to the floor of the pelvis _ the rest of the wound being sutured. The suprapubic wound is closed as in suprapubic cystotomy by transverse incision.

Comments.—Verhoogen, in 2 cases, following total excision of the bladder, excluded the cecum, implanted both ureters into the improvised bladder made therefrom _ and brought the appendix out upon the skin, forming a urinary outlet through the appendicostomy wound, to replace the urethra (Fig. 4805). Both patients survived for some length of time.

TOTAL CYSTECTOMY

BY TEMPORARY OSTEOPLASTIC RESECTION OF THE SYMPHYSIS PUBIS

Description.—The bladder is here exposed through a temporarily turned back flap consisting of part of the resected pubic symphysis, with the recti



Fig. 4806.—Total Cystectomy by Temporary Osteoplastic Resection of the Symphysis Pubis _ I; _ The composite flap of skin, fascia, aponeuroses, central portion of recti muscles, and part of the symphysis pubis has been raised and turned upward. The bladder is being mobilized, extraperitoneally, preparatorily to its excision.

muscles still attached _ after which the bladder is freed extraperitoneally and excised _ through a broad avenue of approach.

Preparation _ Position _ Landmarks.—As in suprapubic cystotomy (v. p. 525).

Incision.—A suprapubic flap is outlined which may be more angular than

the transversely curved flap of Pfannenstiel. Two parallel incisions are made over the outer aspects of the recti muscles, beginning, probably, two-thirds of the way between the level of the symphysis pubis and the level of the umbilicus – extending well down onto the symphysis pubis, where they are connected by a transverse incision, furnishing a flap squarish in outline, with rounded corner.

Operation.—Except for the difference in the shape of the initial incision, the steps of the operation following the incision through the skin and fascia are the same as those described and pictured under transpubic cystotomy, by osteoplastic resection of the pubic arch (v. p. 541) – nor is it of practical importance that the present rectangular flap incision be made rather than

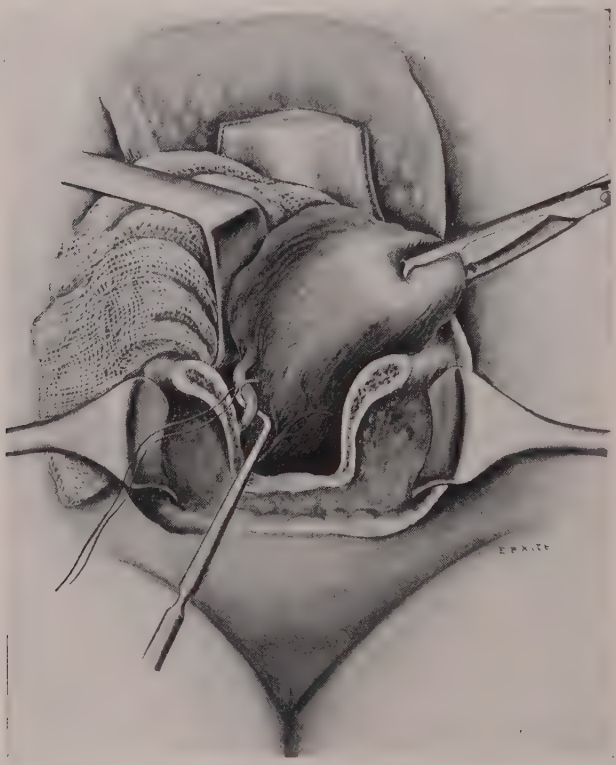


Fig. 4807.—The Same – II; – The bladder is partly mobilized – the unopened peritoneum is being pushed from its posterior surface – exposing the right ureter, which is doubly ligated.

the usual Pfannenstiel curved incision. In the present technic, however, the composite flap of skin, fascia, aponeuroses, the central portion of the symphysis pubis, together with the attached origins of the recti and pyramidales muscles, are all raised, *en masse*, and, unseparated, are displaced upward (Fig. 4806). The bone sections are best made by motor saw or by chisel. The recti muscles are split in their cleavage line, inside of the lineæ semilunares, after dividing, in a corresponding line, their sheaths.

The peritoneum is everywhere carefully pushed back from the top, sides, and back of the bladder. If it be anywhere torn, or has to be deliberately cut because of adhesions, or otherwise to a limited extent, the rent is sutured – and effort made to maintain the extraperitoneal feature of the operation.

The manipulations are aided by grasping the anterosuperior aspect of the bladder with clamp forceps. As the freeing of the bladder proceeds backward and downward, the ureters are exposed, doubly ligated, and divided near to the bladder (Fig. 4807), and the lateral vascular pedicles are similarly doubly ligated and divided on each side. Finally, the base of the bladder is freed from the rectum — until the neck of the bladder is reached — when the deep urethra is ligated, divided, and cauterized — and the bladder removed. All bleeding is controlled by ligature and packing.

The composite flap is turned back into place — the bone and soft parts being sutured as described under the osteoplastic exposure of the bladder for cystotomy (v. p. 541).

Drainage is also employed as there described — and in addition, counter-drainage may be instituted through the perineum if considered necessary.

The disposition of the ureters will usually have been provided for by some form of preliminary operation — described, for instance, in connection with the operation of total cystectomy by the suprapubic, extraperitoneal route (v. p. 604).

TOTAL CYSTECTOMY IN THE FEMALE

BY COMBINED SUPRAPUBIC AND VAGINAL ROUTES—PAWLIK

Description.—The ureters are, preliminarily, diverted into the vagina, which is eventually converted into a receptacle for the urine. Subsequently the bladder is exposed through combined suprapubic and vaginal incisions, and removed through the vagina.

Preliminary Diversion of the Ureters and Creation of Double Ureterovaginal Fistulæ.—Through a Simon speculum a metallic sound is conducted into each ureter, and on these sounds, as guides, the ureters are exposed by an incision in the anterior vaginal wall, over each ureter. The ureters are then drawn into the vaginal wounds by a silk loop thrown around each ureter and lightly knotted. Each ureter is longitudinally incised to the extent of 1 cm. (6/16 inch), and the margins of the incised ureters are stitched to the upper part of the vaginal incisions. Having withdrawn the ureteral sounds, the ureters are cut across distally and the loop ligatures now removed. The mucosa of the cut ends of the ureters is sutured to the mucosa of the vaginal incisions. Rubber ureteral catheters are introduced into the mouths of the vaginally anchored ureters, and the urine therefrom conducted into a receptacle. These catheters are withdrawn in a few days — after which the ureteral orifices are periodically dilated by bougies.

Exposure of the Bladder Suprapubically.—Two or three weeks after the diversion of the ureters the bladder is filled with fluid, and exposed by a median suprapubic incision — through which the upper, lateral, and posterior aspects of the bladder are freed of peritoneum by blunt dissection as far back as the urethra. If the peritoneum be anywhere torn, in this freeing, the rent is sutured — so as to conduct the operation as an extraperitoneal procedure, as far as possible. The contents of the bladder are now allowed to escape — and the suprapubic wound is temporarily packed to control hemorrhage.

Exposure and Excision of the Bladder Vaginally.—Immediately following the suprapubic technic a median vaginal incision is made just below the urethra — and between the retracted lips of the vaginal incision, the bladder, already freed through the suprapubic incision, is delivered into the vagina. The deepest part of the urethra is then divided, opposite the neck of the bladder — and the bladder removed through the vagina. Elastic ureteral catheters are placed in the ureters — and brought out through the urethra.

The divided end of the urethra is so sutured that the anterior wall of the urethra is attached (sutured) to the anterior vaginal wall, and the posterior wall of the urethra to the posterior vaginal wall _ thus converting the vagina into the receptacle for the urine which formerly was the bladder.

The suprapubic and vaginal wounds are closed up to the exit of temporary drainage.

Closure of the Vagina.—At a later date the walls of the vagina are brought together laterally (v. Colpocleisis, Index, Vol. VI) _ posteriorly to the urethral outlet, thus converting the vagina into an improvised bladder, of a capacity of about 400 c.c. _ with the power of spontaneous emptying through the urethra, when the perineal muscles were voluntarily contracted.

OPERATIONS UPON THE MALE URETHRA

These will be found under Operations Upon the Male Urethra (Chapter LXXVII, p. 615).

OPERATIONS UPON THE FEMALE URETHRA

These will be found under Operations Upon the Female Genital Organs (Chapter LXXXIV, v. Index, Vol. VI).

CHAPTER LXXVII

OPERATIONS UPON THE MALE URETHRA

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Operations for epispadias, in general, p. 717; _ Operations for epispadias, p. 717.

Operations for hypospadias, in general, p. 728; _ Operations for hypospadias, p. 729.

SURGICAL ANATOMY OF THE MALE URETHRA

Description.—Extends from bladder opening to external urinary meatus _ from 20.5 to 23 cm. in length (8-9 inches). It consists of muscular, erectile, and mucous tissue. It is divided into prostatic, membranous, and spongy portions.

Prostatic Portion.—About 3.2 cm. ($1\frac{1}{4}$ inch) long. Passes through the prostatic gland, near its upper aspect, from base to apex. The following objects are upon the floor of the prostatic urethra, from behind forward: _ (*a*) verumontanum, an elevation of mucous membrane in the middle line; _ (*b*) prostatic sinuses, one upon each side of the verumontanum, with the orifices of the prostatic ducts opening into them; _ (*c*) sinus pocularis, a culdesac lying in front of verumontanum and passing backward for about 1.3 cm. ($\frac{1}{2}$ inch) into the substance of the prostate gland, beneath the central lobe; _ (*d*) openings of the two ejaculatory ducts into the orifice of the sinus pocularis.

Membranous Portion.—Portion of urethra between the two layers of the triangular ligament _ about 2 cm. ($\frac{3}{4}$ inch) long upon its anterior, and 1.3 cm. ($\frac{1}{2}$ inch) long upon its posterior aspect. Extends between apex of prostate gland and posterior aspect of bulb of corpus spongiosum. Its anterior

surface is about 2.5 cm. (1 inch) below the pubic arch _ the dorsal vessels and nerves and some muscular fibers intervening. It pierces both layers of the triangular ligament, receiving an investment from each. It is surrounded by the compressor urethræ muscle.

Spongy Portion.—About 15.5 cm. (6 inches) in length. Extends entire length of corpus spongiosum, from bulb to external meatus. The portion within the bulb is sometimes called the "bulbous urethra." The ducts of Cowper's glands open upon the floor of the bulbous portion. The glands of Littré open upon the mucous membrane of the penis, especially upon the floor of the spongy portion. One of these, the lacuna magna, opens upon the roof of the fossa navicularis, about 2.5 cm. (1 inch) from the external urinary meatus. The fossa navicularis is situated within the glans penis.

Narrowest Portions of Urethra.—At external meatus; in the membranous portion; at the neck of the bladder.

Vessels and Nerves.—See under Penis.

SURFACE FORM AND LANDMARKS OF THE MALE URETHRA

The base of the triangular ligament can be felt through a thin perineum.

The membranous urethra pierces the triangular ligament about 2 cm. ($\frac{3}{4}$ inch) below the subpubic ligament _ and about 2 cm. ($\frac{3}{4}$ inch) in front of the central tendinous point of the perineum.

GENERAL SURGICAL CONSIDERATIONS IN OPERATING UPON THE MALE URETHRA

Stricture never occurs in the prostatic urethra _ and is very rare in the membranous _ hence one may generally count upon finding a patulous urethra after cutting down upon that portion emerging from the apex of the prostate gland.

For other general considerations see Urethrotomy.

URETHROSCOPY

In urethroscopy the interior of the urethra is usually examined by means of a hollow, tubal type of instrument _ of which two forms are in general

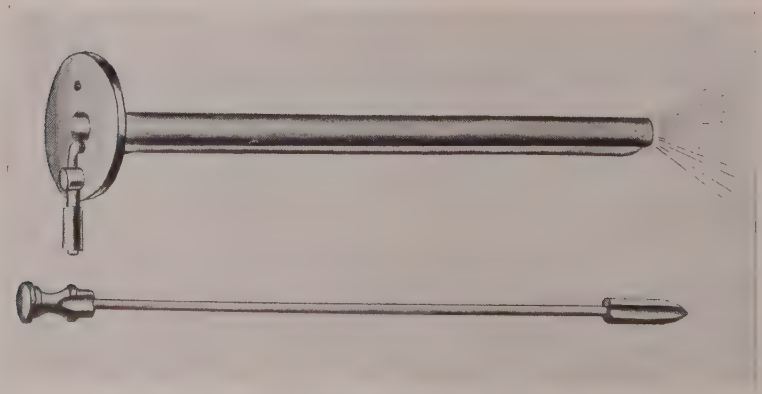


Fig. 4808.—Electric Ureteroscope for the Anterior Urethra.

use. In one the illuminating electric lamp is at the inner end of the urethroscope, or the end which first enters the meatus _ constituting the direct form

of illumination. In the other the source of illumination is outside of the endoscopic tube, and light is reflected by means of a mirror, also outside of the tube, down through the eye-end and tube, to the examining end of the tube _ constituting the reflected form of illumination.

The direct illumination urethroscopes are more generally used than those employing reflected illumination. Forms of these instruments are shown in

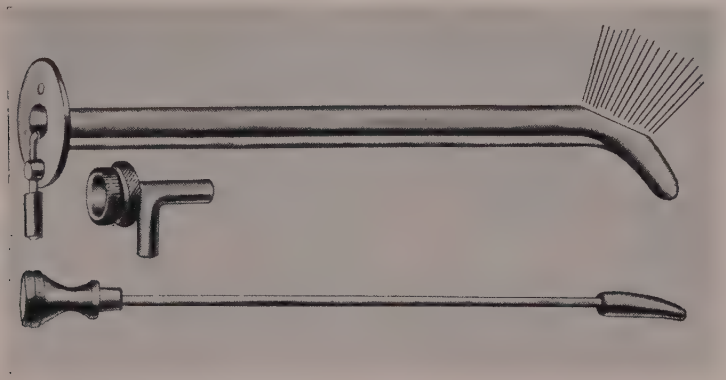


Fig. 4809.—Electric Urethroscope for the Prostatic Urethra.

Figs. 4809–4813 _ in which are seen the straight types of instrument, for examining the more anterior portions of the urethra _ and the curved, for examining the deeper portions.

The special advantage of having the light within the tip of the far end of the instrument is in the employment of curved instruments _ whereas its disadvantages are the heat generated and the blurring apt to be occasioned in the presence of fluids.

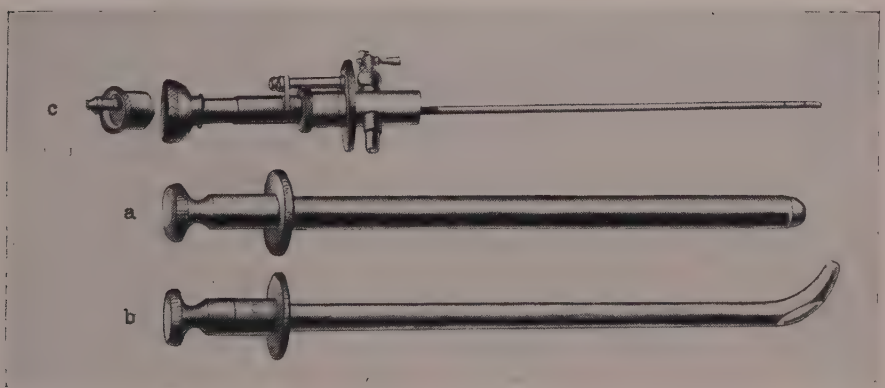


Fig. 4810.—Greenberg's Operating Urethroscopes: _ a, Long, straight urethroscope; _ b, curved urethroscope for deep urethroscopy; _ c, optical and electric attachment.

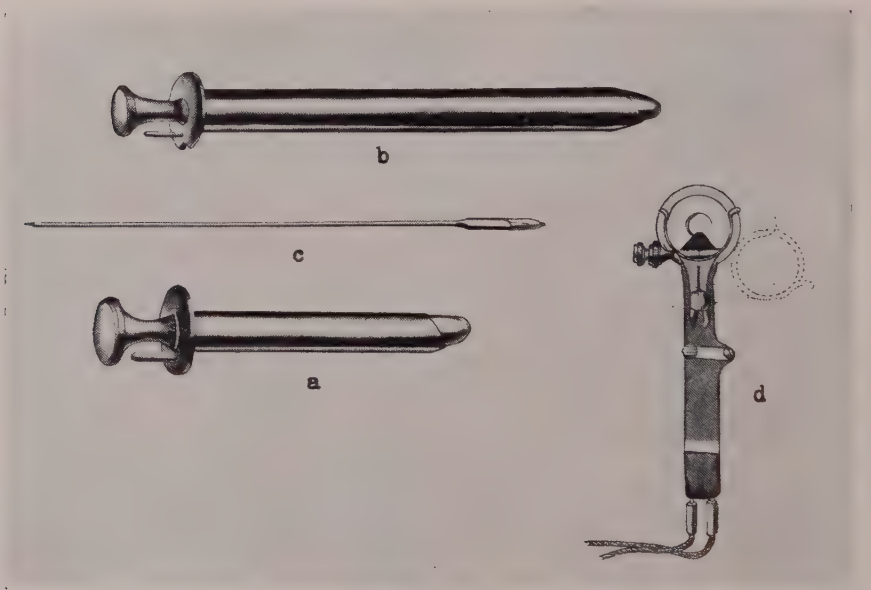
The uretherscope is used in a threefold capacity _ for making diagnostic examinations _ in applying substances to the urethral mucosa _ and as furnishing the approach for operative measures.

In addition to the above types of urethroscopes, a limited portion of the anterior urethra, in male and female, can be examined by means of a small

dilating urethral speculum, preferably of the wire form, so that its separating blades will obscure as small a part of the urethral wall as possible.

Manner of Introducing the Illuminating Urethroscope.—The instrument may be employed with the patient in either the recumbent, or semi-recumbent posture. The latter position is generally used – the Surgeon sitting in front of the patient, between his widely separated legs, with his examining eye upon a level with and opposite the optic end of the instrument. The largest size tube is selected which will readily pass the meatal opening. It is sterilized by boiling – and lubricated with sterilized oil or substitute.

The penis is held in the left hand, somewhat suspended, in such a manner that fingers are applied to one side of the organ, and the thumb to the opposite – the lips of the meatus being held apart between the thumb and first finger (Fig. 4814). The fingers which at first separate the meatal lips subsequently



Figs. 4811–4813.—Luys' Electric Urethroscopes: – a, Anterior urethroscope; – b, posterior urethroscope; – c, electric lamp; – d, eye-piece and electric attachment.

help to support the advancing and examining instrument. The urethroscope is carried steadily and gently backward, unless its progress be mechanically interrupted, until its tip reaches the bulbomembranous portion of the urethra. The obturator is then withdrawn – the light turned on – the urethra mopped dry of fluid, or the fluid withdrawn by a delicate suction drainage-tube. In urethroscopes specially provided, the urethra, within the field of view, is distended by air – so as to roll out the urethral walls, and make them easier of examination. The tip of the instrument is then slowly withdrawn, carefully examining all sides of each new segment of urethra which comes into the field and closes in, funnel shaped, behind the receding instrument.

If the onward passage of the urethroscope is blocked, upon its original introduction the examination then begins at this point of obstruction – and is made both in the inward progress, especially stopping at each obstruction – and in its withdrawal.

In examining the prostatic urethra a curved tube should always be employed _ though the examination may be made, with somewhat greater difficulty and pain, with a straight one. In these deeper examinations, also, analgesia may be indicated _ which may be accomplished either by injecting a few mimims of a 1 or 2 per cent. cocain solution, prior to introducing the urethroscope _ or the application of cocain may be made through the tube after the obturator is withdrawn. In the introduction of the instrument, when its tip has entered the membranous urethra (its shaft being more nearly parallel with the axis of the patient's body), the handle of the urethroscope is depressed, in the sitting posture of the patient (that is, brought away from the abdominal wall _ in any posture of the patient) _ and the tip is thus made to enter the prostatic urethra. Upon the completion of the examination of the prostatic



Fig. 4814.—Introduction of Electric Urethroscope _ for examination, and for technical procedures. The obturator has, here, been withdrawn.

urethra it is generally best to first reintroduce the obturator before withdrawing the instrument _ as the open window is apt to catch the structures in the neighborhood of the verumontanum.

The normal structures which will be encountered in the examination of the prostatic urethra (which is best accomplished with the pelvis more elevated than in the examination of the anterior urethra) are the following: the verumontanum, in the median floor _ the sinus pocularis, opening as a slit in a depression upon the verumontanum _ the prostatic sinuses, to the sides of the verumontanum.

In examining the bulbous urethra from within, outward, one sees a median dimple, at the end of the field, where the compressor urethra muscle brings the walls of the membranous urethra tightly together; _ a whitish median elevation, marking the line of the ducts from Cowper's glands; _ a transverse

fold caused by the suspensory ligament, at the penoscrotal junction; – the round, or slit-like openings of the lacunæ, upon the urethral roof, increasing in number as the meatus is approached; – the lacuna magna, in the urethral roof, where the penile urethra and fossa navicularis meet, generally bounded by two lateral and an axial fold.

No force should be used at any part of the urethral examination.

If the instrument seems to be obstructed at the penoscrotal junction, this may generally be overcome by simultaneously drawing out the penis, and carrying the instrument both toward the abdominal wall and downward.

Examination made without prior urination may encounter flakes of exudate – which immediately previous urination would have removed – so that such urination, in an undiseased tract serves, practically, as a saline irrigation in preparation for urethroscopy.

Apart from urethroscopic examinations, intra-urethral operations may be performed through the approach secured through the tube of the urethroscope.

PASSAGE OF URETHRAL SOUNDS

Sounds are solid instruments – generally metallic – sometimes of rubber and of other pliable material, such as silk, whalebone, and the like. When

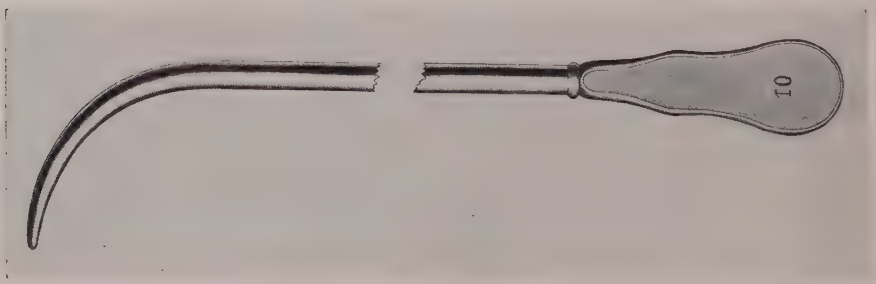


Fig. 4815.—Conical Metallic Sound – for male urethra and bladder. (Its point is probably here represented too conical, and the flat of the handle should be at right angle to the axis of the curve of the shaft.)

metallic, they are, of course, rigid. Those of all soft materials are more or less pliable. Rigid instruments are always technically directed, along anatomic lines, in their passage. Soft instruments are simply carried blindly through the canal, after once entering it, by pressure from behind. No force is used in passing any instrument through the urethra.

Sounds are passed through the urethra either for the purpose of examination or to dilate the canal. Very small, special sounds, such as filiform bougies of whalebone, are often used preliminarily for the purpose of opening up a contracted urethral tract for the passage of instruments of larger size and more rigid structure.

Most sounds are concical – some are bulbous at their ends. Those which are capable of maintaining their form, while possessing a general similarity of curvature, based upon the anatomy of the parts, are variously modified in their curves, even to the extent of the passage of the curve into an angle. Special types of sounds are employed in such conditions as the pathologic results of prostatic hypertrophy.

The curvature and length of female sounds are less than in the male instrument.

The passage of urethral sounds differs in no practically essential respect

from the passage of catheters into the male and female bladders – the technic of which has been already described.

A general type of male urethral sound is shown in Fig. 4815 – and in Fig. 4816 is seen a combination gage for measuring both solid sounds and hollow metallic catheters.

A sound may be passed from the patient's left side or from his right – the former being the technic more usually practised. In either event, the patient lies in the fully recumbent posture, in complete relaxation – with head slightly elevated, and thighs slightly separated. The penis is thoroughly cleansed, especially the glans and meatal opening, and disinfected. A satisfactory and practical manner of safeguarding the surrounding field, as well as of securing a sterile resting place for an extra instrument, is to bring the penis through a slit made in the center of a sterile towel, just large enough to admit it. The sterile sound is warmed and lubricated with sterile lubricant and the meatal opening is lubricated. The patient usually urinates just before these preparations are made.

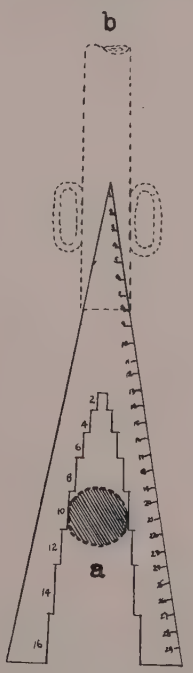


Fig. 4816.—Metal Form or Gage – graduated to register both the diameters of sounds and the calibers of catheters. (Modified from Kelly and Noble.)

In Passing the Sound From the Patient's Left Side the Surgeon stands to the left of the patient, directly facing his left hip. He takes the handle of the sound in his right hand, with the tip of the instrument pointing downward – and grasps the penis between the fingers and thumb of his left hand. If the glans penis be covered by the prepuce, this is drawn backward, over the head of the organ, by his left fingers. In grasping the sound, the Surgeon may either do so with the back of his hand upward – or he may balance the handle of the sound between his thumb and fingers, with palm upward (Fig. 4817).

In the first step of the passage the handle of the sound may be held either directly in the median line, as is probably usually done, or it may be held over the fold of the groin. In either case the shaft of the instrument is parallel with the surface of the skin. The beak of the instrument, with the point downward, is carried through the meatus, into the glandular portion of the urethra. If the introduction have been begun obliquely, over the groin, the instrument is then brought squarely into the median line – where, if the more usual technic have been carried out, it already is. Hardly more than the curve of the instrument disappears in this stage of the introduction.

In the second stage of the passage (Fig. 4817) a combination of movements in opposite directions is carried on – the right hand continues to press the instrument, still parallel with the abdominal wall, onward along the spongy urethra – while the left hand draws or pushes the penis toward the handle of the sound – making the urethra, as it were, swallow the sound. This maneuver is continued until the tip of the sound has reached the penoscrotal junction – the site of the suspensory ligament of the penis – and the end of the freely movable part of the urethra. Thus far the passage is always easy in a normal canal and with average sizes of instrument.

In the third stage of the passage as soon as the penoscrotal junction has been reached the elevation of the shaft is begun (and not before) – beginning parallel with and near the abdominal surface, and ending almost vertical –

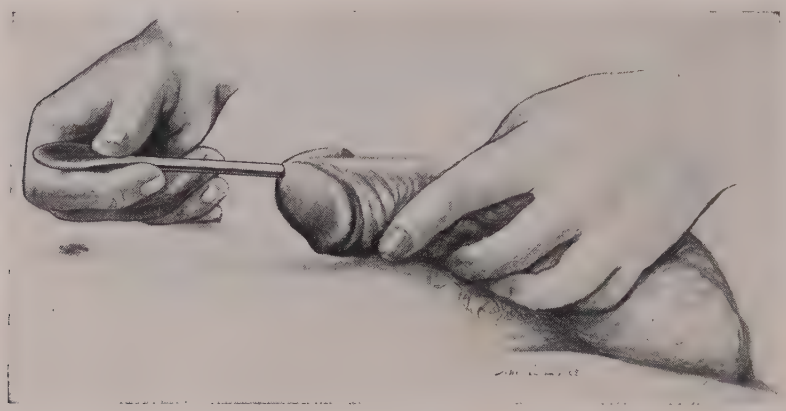


Fig. 4817.—Passage of a Sound from the Left Side of the Patient – Stage I; – This technic is here viewed from the right side – and also illustrates a method of rather pushing the penis onto the sound – than of pulling it on, as in Fig. 4820.

the handle of the sound passing through nearly a quarter of a circle – while the beak of the instrument is passing under and rounding the subpubic arch, the concavity of the instrument applying itself to the hollow of the pubic



Fig. 4818.—The Same – II; – The handle of the sound (now held in the Surgeon's left hand) is depressed between the patient's thighs, while carrying the tip of the instrument through the membranous and prostatic urethra. The fingers of the opposite hand are depressing the root of the penis at this stage, so as to put the suspensory ligament of the penis upon the stretch, and thereby lessen the curvature of the membranous portion of the urethra during the transit.

arch, and following the urethral curve. The third stage ends with the tip of the instrument engaged in the membranous urethra. When difficulty is experienced, it is generally encountered immediately anterior to the tri-

angular ligament, and is occasioned by the tip of the sound impinging upon the lower aspect of this ligament – which, in turn, occurs because the roomier bulbous portion of the spongy urethra, which has just been traversed, allows the tip of the sound to sag against the lower segment of the triangular ligament. The usual method of overcoming this is to exercise pressure with the finger-tips of the left hand, against the perineum, opposite the membranous urethra, posterior to the scrotum (while the latter is supported in the palm of the hand) – and thus *lift* the tip of the sound over this obstacle, and direct it into the



Fig. 4819.—Passage of the Urethrovesical Sound – seen in cross-section, in the act of withdrawing the sound. In Stage IV, of introducing the sound, its shaft is lowered until parallel with the thigh.

membranous urethra (v. Fig. 4823). It is ideal if the sound can *drop* from the vertical, as it were, around the pubic arch, rather than be *pushed* around it, and *lifted* past the triangular ligament – and this is often possible in the normal urethra.

In the fourth stage of the passage (Fig. 4818) the handle of the instrument is depressed, between the thighs of the patient, at the same time that the instrument is steadily but gently advanced – until it enters the bladder by gliding up the inclined plane of the prostatic urethra – the entry of the sound



Fig 4820.—Passage of Urethral Sound from the Patient's Right Side – I; – Introduction of the sound through the meatus, into the beginning of the spongy portion of the urethra

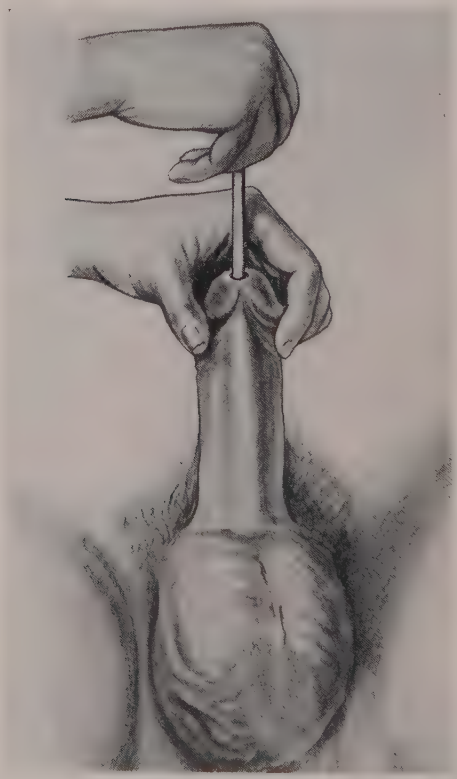


Fig. 4821.—The Same – II; – The vertical passage of the sound through the spongy urethra to the peno scrotal junction.

into the bladder being verified by the ability to turn the curved tip of the instrument upon its own axis in any direction. The chief difficulty experienced in this stage of the passage is the premature depression of the handle of the sound, causing a blockage of the tip by a fold of the bulbous urethra. Under such circumstances the sound should be slightly withdrawn, then passed more deeply into the urethra (hugging, in alternate trial, either the upper or lower urethral wall) before being depressed.

A sectional view of a urethral sound *in situ* is seen in Fig. 4819.

The examination having been completed, the sound is withdrawn by the reverse movements of the steps just described.

Special manipulations are required in dealing with strictured urethræ – as will be described below.

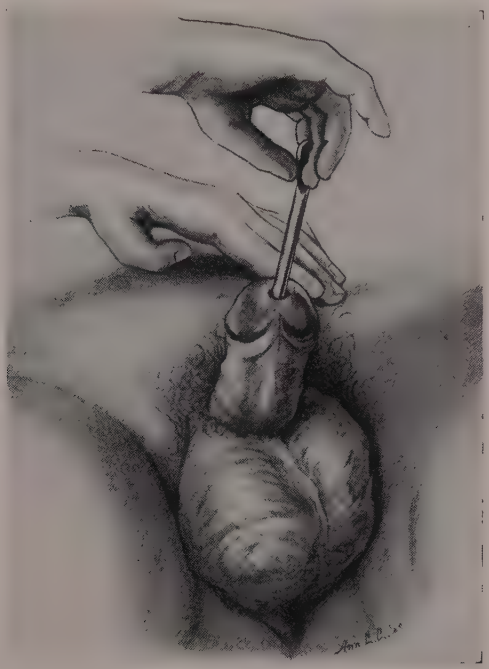


Fig. 4822.—The Same – III; – The sound sweeps beneath the symphysis pubis, and, with the lowering of the handle, passes on through the membranous and prostatic urethra, into the bladder. The fingers of the left hand are upon the abdomen.

In Passing the Sound From the Patient's Right Side.—The practical features of the passage are exactly the same as just described in the passage from the left side as to the technical procedures – the only differences being in the manipulations necessitated by the position of the Surgeon and his hands.

The engagement of the sound in the beginning of the urethra is seen in Fig. 4820.

The passage of the sound through the spongy urethra down to the penoscrotal junction is shown in Fig. 4821.

The lowering of the sound to enter the membranous urethra in cases where no difficulty is experienced is seen in Fig. 4822.

The guiding of the tip of the sound past the triangular ligament, into the membranous urethra, in cases where it catches against the lower segment

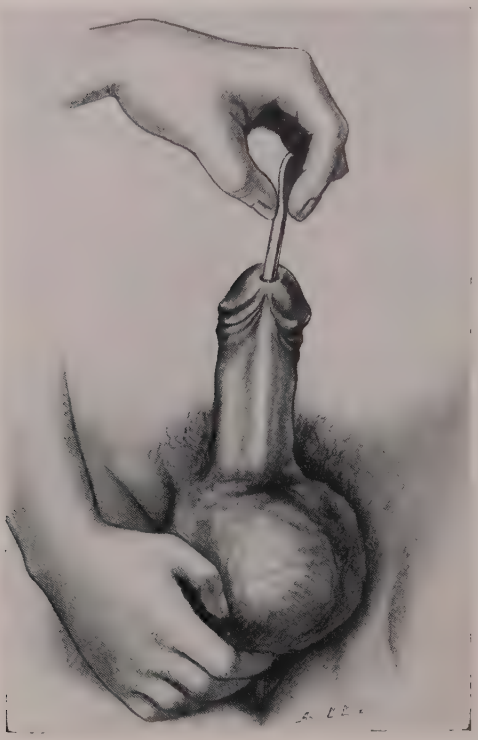


Fig. 4823.—The Same _ IV; _ The passage of the sound through the membranous portion of the urethra may sometimes be aided by pressure of the fingers against the convexity of the sound, through the perineum, to lift its tip past the triangular ligament.

of the ligament, by means of digital pressure in the perineum, is shown in Fig. 4823.

METHODS OF RETAINING CATHETERS IN SITU IN THE BLADDER AND URETHRA. PORTABLE MALE URINALS

The technic of passing catheters through the urethra and into the bladder has been already described and pictured.

The manner of retaining such catheters in bladder and urethra, by several different methods, of the many ingenious ones devised, will be here given.

Watson's split catheter method is shown in Fig. 4824. Before the catheter has been carried into the bladder a piece of rubber drainage-tube about 12.5 cm. (5 inches) long, and of the right size to slip over the catheter, but still cling to it (the caliber of the catheter being one size larger than the inner caliber of the tube) is axially split down its two sides for about 10 cm. (4 inches) of its length _ and is then carried over the end of the catheter which will protrude from the meatus, with its split ends directed toward the root of the penis. To enable the retention apparatus to be shifted the diameter of of the catheter is made smaller by stretching it. When the proper calculation is made, the catheter is passed into the bladder _ until the meatus is pressed up near the junction of the two split sides of the retainer. Finally a narrow band of zinc-oxid plaster is carried around the two split ends, binding them

to the penis. Rather than use an encircling band of plaster, it is safer to use two pieces, one for each strip, and so place them that they do not surround the organ – and in this way there can be no possible constriction.

Special forms of muzzles, with collars passing behind the corona glandis, with an opening at the end for the catheter to pass through, are in use – such as shown in Fig. 4825.

Another form of collar and snaffle catheter retainer is seen in Fig. 4826.

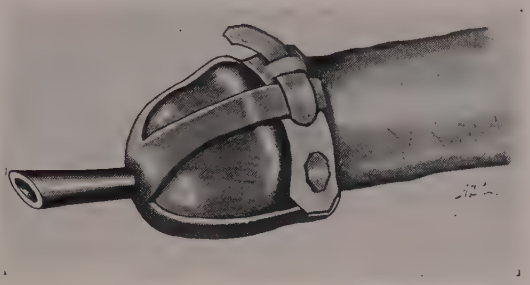


Fig. 4825.—Catheter Retainer.

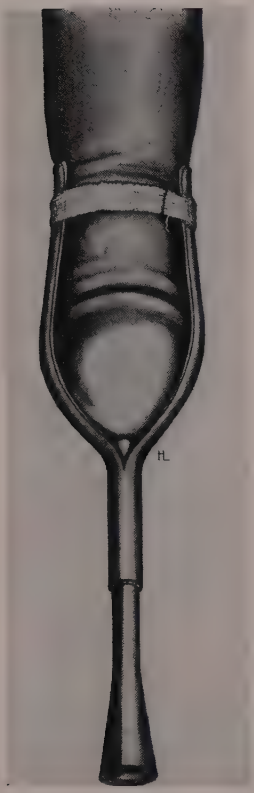


Fig. 4824.—Watson's Split Catheter, Serving as a Holder for the Bladder Catheter of Smaller Size. The End of the Catheter Need Not Be Expanded.

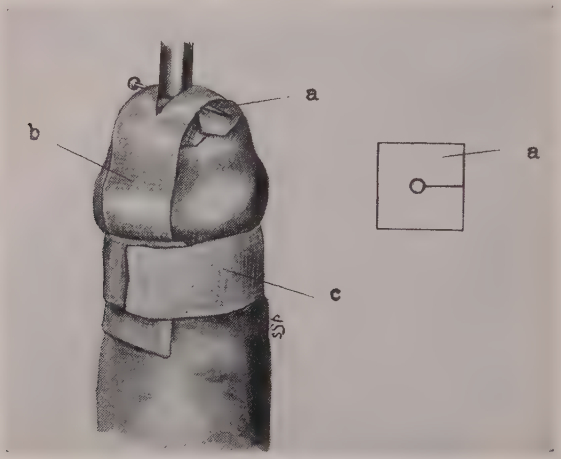


Fig. 4826.—Ferria's Catheter Retainer.

Dittel's method of retaining the catheter is illustrated in Fig. 4827 – but here, as elsewhere, it is better to let the encircling strip of zinc-oxid plaster nearly but not quite surround the penis.

A clever form of button retainer for the catheter, with its accompanying dressing, is seen in Fig. 4829.

Apart from the subject of methods of retaining catheters which are usually employed following special operations upon the urethrocystic tract, there



Figs. 4827 and 4828.—Dittel's Method of Fastening Catheters in the Urethra: – a, a, Perforated, slit square of zinc oxid plaster, surrounding the catheter and sticking to the glans. The pin traversing the wall of the catheter rests upon this. The longitudinal, b, and encircling, c, pieces are placed as shown.

often arises the necessity for making provision to collect the urinary outflow from the uncatheterized bladder and urethra – and, to this end, special forms

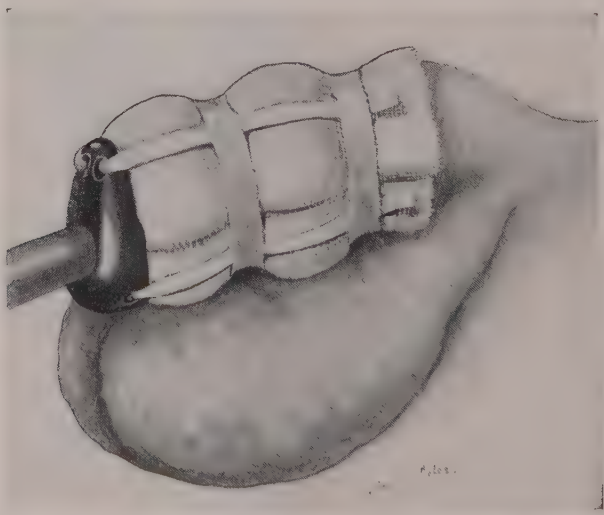


Fig. 4829.—Catheter Held in Position by a Watson Button; – a Gauze Dressing of the Penis Retained by Strips of Zinc Oxid Plaster. (Modified from Watson and Cunningham.)

of portable urinals are made for use during the daytime, as well as modified forms for use at night – of such types as are shown in Figs. 4830 and 4831.

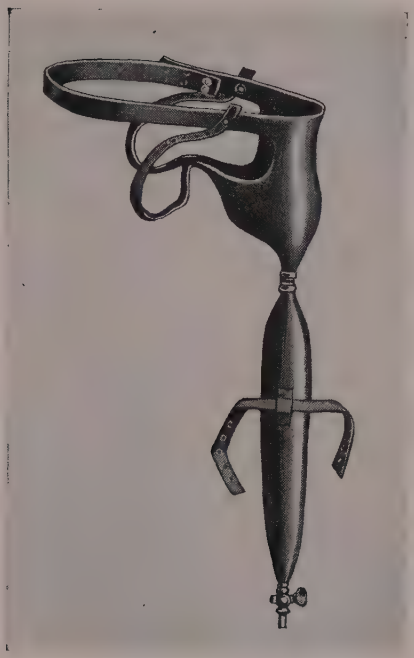


Fig. 4830.—Rubber Male Urinal for Day Use.

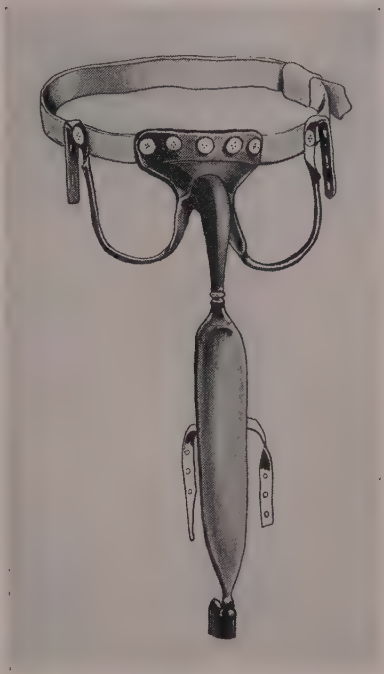


Fig. 4831.—Rubber Male Urinal for Day and Night Use.

INJECTION AND IRRIGATION OF THE MALE URETHRA

Various methods of flushing out the urethra are in use, of which the following are some of the procedures most commonly employed. The chief indication is infection of the tract.

Injection of the Anterior Urethra.—This is usually accomplished by means of an all-glass, conical (non-wounding or blunt-pointed) glass syringe of 2 drams capacity (Fig. 4832, **b**). After half filling the syringe from a wide-mouthed bottle, hold it vertical, with tip uppermost, but out of the axis of the patient's own eyes, and press the piston homeward sufficiently far to remove all air from the barrel. The patient then urinates – takes the syringe in his right hand – and separates the lips of the meatus with the thumb and first fingers of the left hand. He places the blunt nozzle of the syringe in the orifice of the meatus, and closes the meatal lips about it in such a way as to direct the tip of the syringe toward the floor of the urethra by compressing the upper aspects of the lips. The piston is then evenly and steadily compressed until its contents, usually a dram, have been expelled into the urethra – after which it is carefully withdrawn, while during the withdrawal the left thumb and index completely approximate the lips of the meatus – thus holding within the urethra the injected fluid for the length of time indicated, which will differ with the nature of the solution employed in the injection (varying usually from thirty seconds to five minutes). At the end of the retention the meatal lips are released and the fluid allowed to escape.

Irrigation of the Posterior Urethra.—This may be accomplished in one of several ways. In some of these the bladder is intentionally entered – in others it is undertaken to irrigate the deep prostatic and membranous

urethra, without entering the bladder. Urination should precede deep irrigation. It is convenient to employ an irrigating stand in the different forms of deep urethral irrigation.

Irrigation of the deep urethra by means of a catheter of appropriate size introduced into the bladder connected with an irrigating outfit, and with air expelled by the passage of some of the fluid until the catheter is engaged in the meatal urethra, is passed directly through the urethra and into the bladder. The fluid from the irrigating reservoir is then allowed to flow into the bladder – after which the catheter is withdrawn – and the patient voluntarily urinates – the contents of the bladder, consisting of medicated fluid, thus irrigating his urethral tract in its exit.

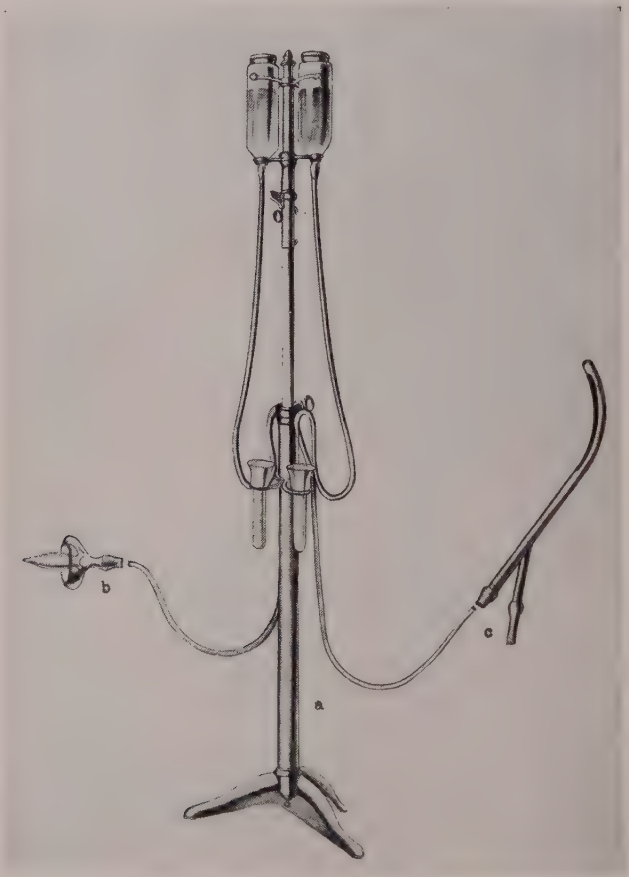


Fig. 4832.—Instrumentation for Male Urethral Irrigation: – a, Movable stand, with double reservoirs; – b, anterior urethral irrigator, with glass shield; – c, double flow membranous and prostatic urethral irrigator.

Irrigation of the Deep Urethra by Means of a Double-flow Metallic Irrigator (Fig. 4832, c): The irrigating cannula is carried into the urethra until its tip is in the deep urethra, but not in the bladder – after which the fluid is allowed to flow – medicating the parts, and escaping partly by the return cannula and partly alongside of it.

Forced Irrigation of the Deep Urethra from the Meatal Orifice (Fig. 4832, b): A blunt, conical nozzle, shielded, is carried into the meatal urethra – and with the patient in a condition of instructed relaxation, so that the posterior urethra will remain patulous, the fluid from the reservoir, at an elevation of about 3 feet, flows into the bladder by gravity. Sometimes the fluid in this technic is carefully forced into the bladder by means of a large syringe, the blunt tip of which has been inserted into the meatal orifice – a less desirable method than the one just mentioned.

Some of the irrigating solutions frequently employed are: argyrol, from 5 to 20 per cent.; – protargol, from 1 : 400 to 1 : 200; – silver nitrate, from 1 : 10,000 to 1 : 5000; – zinc sulphate, from 1 : 500 to 1 : 200; – potassium permanganate, from 1 : 5000 to 1 : 2000; – silver permanganate, from 1 : 4000 to 1 : 2000.

REMOVAL OF INTRA-URETHRAL PAPILLOMATA AND POLYPI

Intra-urethral warts are usually first exposed in the field of the urethroscope – removed by a delicate curet, passed through the urethroscope – and their bases touched with silver nitrate, fused upon the end of a probe. As they are generally very slightly attached to the mucosa they may often be seized with special alligator forceps, or double tenaculum forceps (Fig. 4833), introduced through the tube, and twisted, or torn off – their bases being similarly touched with silver nitrate.

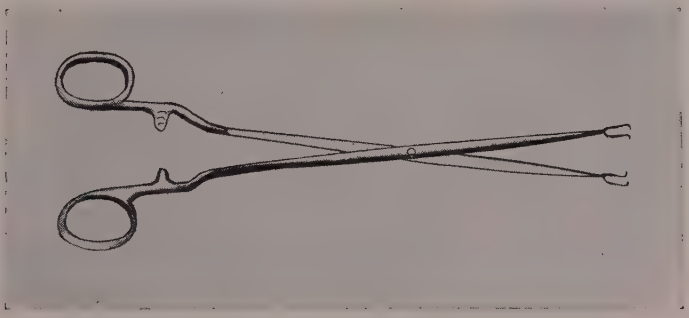


Fig. 4833.—Schroeder's Double Tenaculum Forceps.

Papillomata are sometimes also removed by a small curet, employed through the urethroscope – but the hemorrhage soon obscures the field, and if the growth be not removed in the first sweep of the instrument the latter steps are usually finished in a blurred field.

Oberlander twisted a piece of cotton around a sound, and, passing this down the urethra, frictioned the papillomata off – repeating the operation at different sittings – until their bases were exposed, to which he applied caustic.

Intra-urethral polypi are generally removed by first exposing them in the end of a urethroscope, and then passing down a delicate wire snare and snaring them off (Fig. 4834). The snare is slipped over their bodies and tightened around their necks. They may also be removed by alligator forceps. In using forceps the edge of the urethroscopic tube is carried right up to the base of the polyp – after which the forceps seize the projecting part, and simultaneous traction upon the forceps and slight protrusion of the urethroscope will generally break the polyp off over the margin of the urethroscopic

tube. Some urethroscopic tubes are provided with a window in the outer tube, in which the tumor is engaged _ and the passage of an inner tube, past the

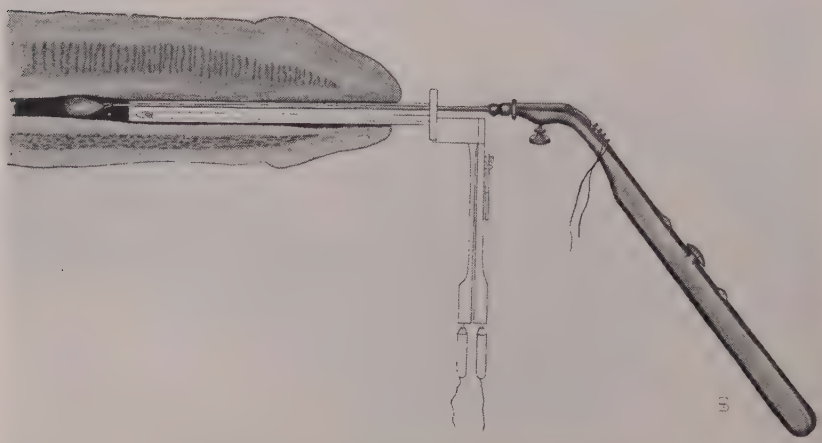


Fig. 4834.—Snaring a Urethral Polypus Through an Illuminated Endoscope.

window, cuts the polyp off. Silver nitrate solution is usually applied to the base of the polyp, no matter how removed.

INSTRUMENTAL EXTRACTION OF STONES AND FOREIGN BODIES FROM THE URETHRA

The special method of procedure will here largely depend upon the nature of the foreign body, and often upon the method of its impaction _ and considerable range of ingenuity has been evolved in the removal of these bodies.

The foreign bodies which are most apt to be encountered are the following: _ calculi, rarely formed in the urethra, but more often arrested in the urethra, after their escape from the bladder; _ parts of instruments which have been passed into the urethra or bladder; _ a great variety of small objects, such as pins, hairpins, slate pencils, kernels of fruits, and the like, passed by masturbators and by weak-minded persons. Calculi are here spoken of as foreign bodies, though, of course, formed within the body.

The localities in which foreign bodies are most apt to be found are the following: _ (*a*) In the Navicular Fossa; _ where stones may be arrested, or where small roundish objects introduced from without are often found; _ (*b*) In the Bulbous Urethra; _ the site of most frequent lodgment, especially holding the elongated objects introduced from without, as well as arrested calculi; _ (*c*) In the Posterior Urethra; _ the site in which lodgment is rarest, in a normal condition of the urethra _ objects most frequently found here are calculi and fragments of instruments; _ (*d*) In the Urethrovesical Region; _ where objects may sometimes pass back and forth between the vesical opening and the beginning of the urethra temporarily lodging in each. In a pathologically constricted urethra the site of stricture will often determine the lodgment of foreign bodies, whether passing, or passed distally, or proximally to the stricture.

There are, in general, two ways of removing calculi and foregin bodies, _

it is ideal to remove them through the urethra by special forceps (Fig. 4835) _ and this should be done when possible _ but it is sometimes necessary to incise the overlying tissues and, finally, the urethra itself, and then remove the object through the opened canal. In the latter instance in appropriate cases the urethra, upon the extraction of the object, is sutured as described in

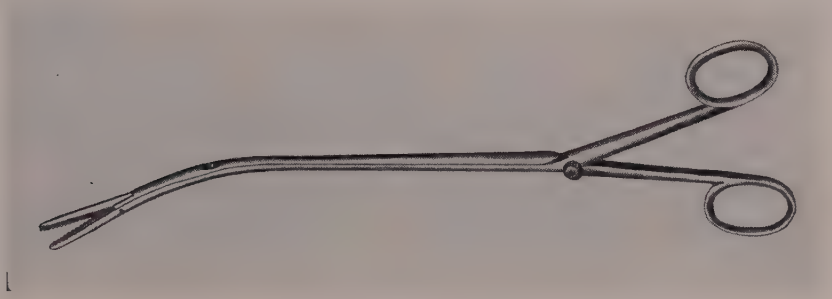


Fig. 4835.—Mathieu's Curved Urethral Forceps.

urethrorrhaphy (p. 640) _ followed by suture of the overlying parts, or by temporary drainage down to the sutured urethra.

Objects of certain kinds and shapes may sometimes be worked or pressed out of the urethral canal by digital manipulation.

Sometimes a large sound may be carried down to the object _ the patient directed to forcibly urinate _ and the sound be suddenly withdrawn _ with

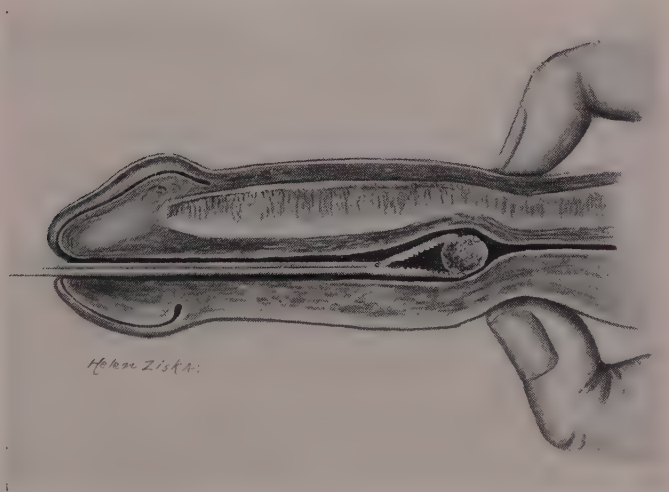


Fig. 4836.—Extraction of Urethral Calculus by Means of Alligator Forceps; _ Fingers behind, steadying the stone and keeping it from slipping backward. (Albarran's technic.)

the successful evacuation of the object, especially if round, in the outgush of urine.

Objects are sometimes removable through the tube of the urethroscope.

The nature of the object should be known before an attempt be made to remove it, if this information can be secured _ as by *x*-raying and urethroscopy. Such knowledge will often aid in determining the best technic to be adopted for its evacuation or extraction.

The removal of a stone from the bulbous urethra by means of special alligator forceps is shown in Fig. 4836.

In Fig. 4837 is seen the removal of a stone by means of a special closed, straight instrument passed beyond it, followed by the elevation of a semi-curved blade, by which it is hooked forward.

Instead of applying this last technic as there illustrated, a straight sound is sometimes passed down to the object – after the special instrument is passed

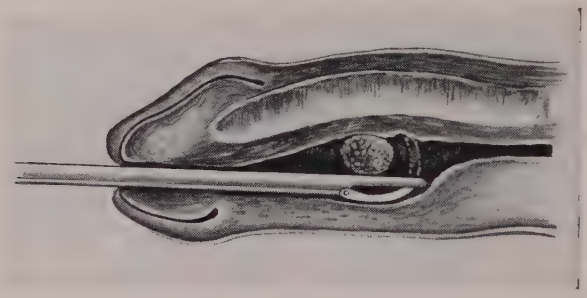


Fig. 4837.—Removal of Urethral Calculus by Means of Special Calculus Extractor; – The instrument is passed under and beyond the calculus, after which the blade is sprung forward and upward, and in the withdrawal of the instrument the stone is pulled forward. (Albarran's technic.)

beyond it – and the stone or object is then hooked forward against the end of the sound – and all are withdrawn together – or the elbowed instrument may be used alone (Fig. 4838).

A stone may be so placed, in the deep urethra, as to necessitate, after resisting other measures, the making of a median perineal section, followed by external urethrotomy, by the nearest available route to the stone – after which a pair of special forceps, guided by a finger, are carried down to and

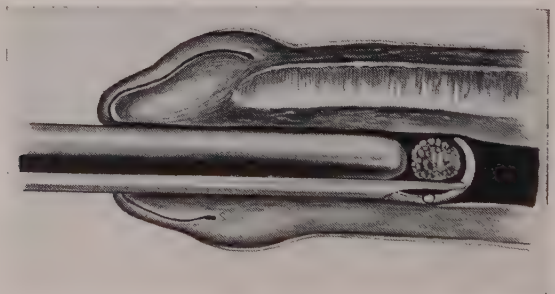


Fig. 4838.—Removal of Urethral Calculus by Combined Manipulation; – A special retractor is introduced beneath and beyond the stone, and the blade sprung. A solid rubber bougie is then introduced into the urethra, down to the stone – against which the stone is then pressed by the extractor, in the act of withdrawal.

grasp the calculus. In order that the stone may not be dislodged forward, and out of reach by the manipulation, it is well to pass a solid instrument through the urethra and down to the anterior face of the object, in order to steady it during the maneuvers (Fig. 4839).

In the extraction of pins which have been pushed, head first, into the male urethra, Hartmann's technic for their extraction is very clever. The penis is first bent, with one finger, preventing the further downward progress of the pin, and the point of the pin made to penetrate the penis, when its point is

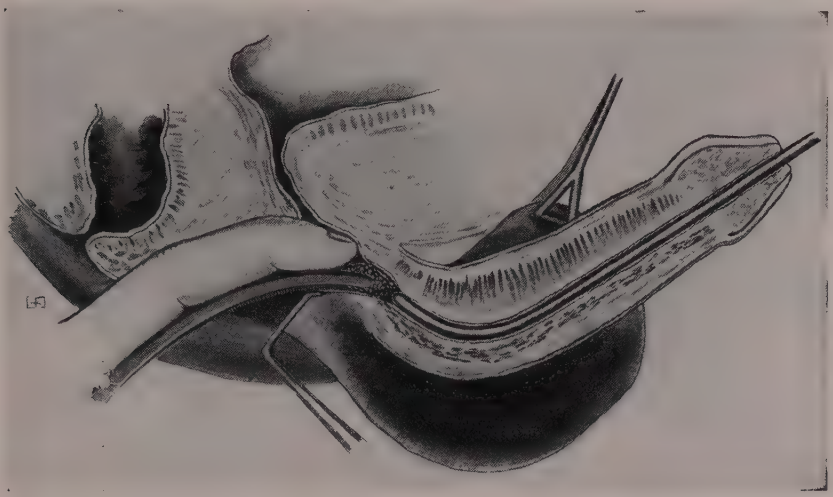


Fig. 4839.—Forceps Extraction of Calculus from the Deep Urethra by the Perineal Route; – The stone being steadied distally, by a sound in the urethra, the perineal section is made – after which the stone is countersteadied, proximally, by a finger in the wound – while special, curved forceps are guided down to, and grasp the stone.

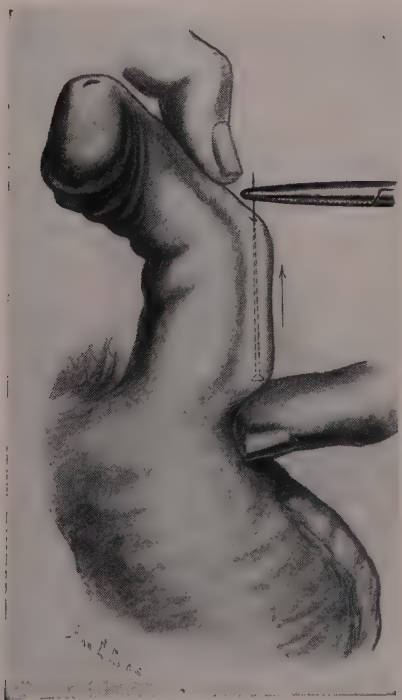


Fig. 4840.—Extraction of Pin from Male Urethra by Version – I; – The head of the pin is kept from going deeper by a finger behind it – while the body of the penis is bent at an angle to thrust the point through the skin. (Hartmann's technic.)

clamped (Fig. 4840). The pin, held by the clamp, is then carried in a sweep, which results in bringing the head where the point was (Fig. 4841) _ which is

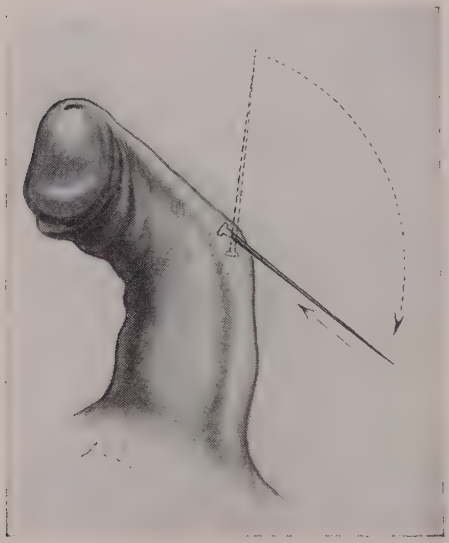


Fig. 4841.—The Same _ II; _ The pin is drawn out, up to its head _ and then reversed, so that the head now points toward the meatus.



Fig. 4842.—The Same _ III; _ The pin is now pushed through the urethra, until its head emerges from the meatus.

also in alignment with the terminal portion of the urethral canal. All that is then necessary to do is to press the pin outward, head first, along the canal, in the direction of its outlet (Fig. 4842).

OPERATIVE REPAIR OF THE WOUNDED OR RUPTURED URETHRA

In cases of partial rupture of the penile urethra it will usually be possible to pass either a urethral sound or, better, a soft-rubber catheter, from the meatus, through the site of partial laceration. If this can be done, the operative procedure will be much simplified. With the sound in place, and guided by the outside traumatism, an axial incision is made over the floor of the urethra, down to the wounded urethra _ which is then mobilized sufficiently for manipulation. The catheter gives the urethra resistant contour, and may generally be seen through the lips of the urethral wound (Fig. 4843). By means of fine forceps, with which the urethral lips are steadied, and a small, curved needle armed with fine catgut, the outer coats of the urethral margins are pierced by needle and suture _ which nowhere penetrate the mucosa. The tying of the sutures close off the urethral lumen from the outside wound. In favorable cases one may risk the entire suturing of the outside wound _ but it is generally safer policy to close the ends of the wound, and drain the center. Sutures may be placed even in the center of the outside wound, but not be tied until the superficial drain is removed, after danger of urinary infiltration is passed.

In cases of complete rupture of the penile urethra, it may not be possible to pass the catheter or sound except from the meatus to the separated end of the distal piece of urethra. After the site has been exposed by incision, the distal end of the proximal portion of urethra may generally be located _ and, while steadied by forceps, the catheter may usually be passed on through



Fig. 4843.—Repair of Lacerated Penile Urethra; – The transversely lacerated urethra is exposed through a median incision, followed by retraction of the wound margins. Non-penetrating, buried, fine catgut sutures close the wound of the urethra – which is then covered by the suturing of the overlying parts – providing for a temporary superficial drain.



Fig. 4844.—Locating the Proximal End of the Ruptured Urethra: – a, a, Retraction of superficial and deep perineal structures; – b, the divided end of the distal urethra, with projecting soft catheter; – c, the ruptured end of the proximal urethra in the deep perineal wound.

the proximal from the distal ruptured end. More dissection to mobilize the ends will usually be necessary – and more manipulation in suturing the less accessible roof of the urethra.

In cases of rupture of the deeper portions of the urethra greater difficulty, and sometimes very great difficulty, is experienced, especially in the finding and then in the suturing of the divided ends. Often one can only pass a soft-rubber catheter or a sound from the meatus down to the outermost divided end. Upon this end, as a guide, as well as guided by the outside traumatism, if recognizable, a median perineal incision is made, and the perineal struc-

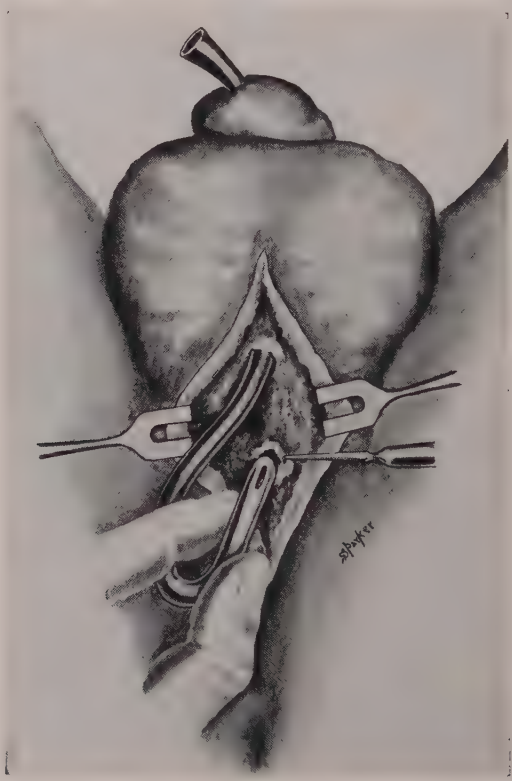


Fig. 4845.—Repair of Lacerated Urethra Where the Severed Ends are Found with Difficulty; – Passage of catheter from the meatus of the penis into the perineal wound – where its end is taken in the fingers and reintroduced into the distal end of the proximal portion of the urethra – and on into the bladder.

tures dissected. The end of the soft catheter is usually readily found, and is drawn out into the wound (Fig. 4844) – and then if the bladder end of the rupture can be located, which can usually be done upon careful searching on anatomic lines, the lips of the proximal end of the deep urethra are held apart by delicate retractor or forceps, and the end of the catheter introduced into the urethral canal – and pushed on into the bladder (Fig. 4845). The lacerated ends of the urethra are then sutured together on the same general principles as in repairing the penile urethra – except, of course, all the steps of the procedure are more difficult, owing to the less accessibility of the field, and the greater depth of the structures. In these cases, particularly, should

no attempt be made to close other than the ends of the perineal wound of approach, as urinary infiltration here would be disastrous – both to the repaired urethra and to the perineal tissues.

In some instances of rupture of the deep urethra it is found impossible to locate the bladder end of the uretha in the deep perineal wound. When

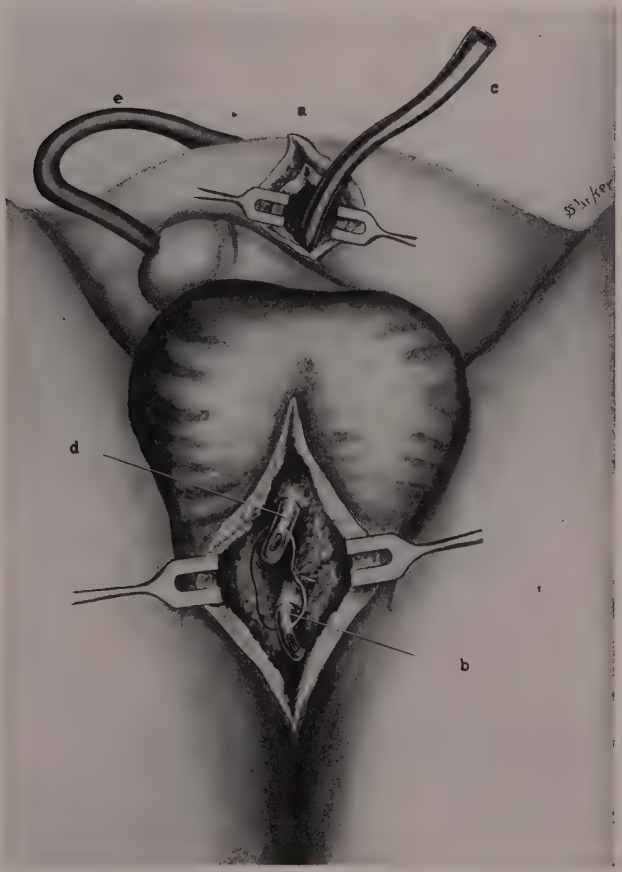


Fig. 4846.—Repair of Lacerated Deep Urethra Where Ends of Wounded Urethra Cannot be Found in the Wound – Accomplished by Catheterization Toward Both Severed Ends: – a, Suprapubic cystotomy wound, through which a catheter, c, has been passed and is seen emerging from the vesical end of the vesical portion of the urethra, in the perineal wound, at b. e, Catheter entering meatus of penis and passing downward and outward through the lacerated end of the penile portion of the urethra, at d. The two free ends of the catheters are then looped together – after which the vesical catheter draws the eyed-end of the urethral catheter into the bladder. The vesical catheter is then withdrawn and the vesical wound closed. The urethral catheter remains *in situ* for bladder drainage. The perineal wound is drained at its center and sutured at its ends. The suprapubic wound is drained down to the bladder.

a reasonable effort has been made to this end, without success, there is no other recourse but to perform a suprapubic cystotomy – and, through the open bladder, practise retrograde catheterization. When the end of the soft catheter appears in the perineal wound, from the bladder end of the ruptured urethra, it is tied to the end of the catheter projecting from the penile end of the urethra – after which the penile catheter is drawn, by traction on

the bladder catheter, on into the bladder, spanning the perineal wound (Fig. 4846). The catheter which entered the bladder through the cystotomy wound is then withdrawn _ the bladder closed by suture _ and also the ends of the suprapubic wound, its center being temporarily drained, down to the sutured bladder. The penile catheter remains in the bladder for drainage. The ruptured ends of the deep urethra are brought together and sutured, over the form of the catheter. The ends of the perineal wound are closed by suture _ and its center drained, down to the repaired urethra.

In some types of ruptured urethra, such as may follow severe blows upon the perineum, the canal may be very irregularly torn, so that before any attempt at repair is possible the margins of the rupture must be extensively pared by means of scissors _ after which the less accessible aspects of the



Fig. 4847.—Suturing of the Extensively Lacerated Deep Urethra Upon a Catheter Following the Trimming of the Lacerated Margins, if Necessary; _ The penetrating circular sutures are shown tied posteriorly and loose elsewhere.

ruptured walls are first sutured _ and then, upon a part of a rubber catheter temporarily introduced, the rest of the stitches are placed. When most of the sutures are tied the catheter is withdrawn, and the rest are tightened. In such a case as that shown in Fig. 4847 the irregular tear may require axial trimming as well _ which is always undesirable if the subsequent sutures must be so placed as to tend to narrow the canal (as transversely placed sutures do) _ rather than broaden it (as axially placed stitches do _ v. Fig. 4843).

URETHRORRHAPHY

Description.—Suturing of the urethra. Indicated in incised and ruptured wounds and in fistula.

Preparation _ Position.—As for Urethrotomy.

Landmarks _ Incision.—Determined by nature and site of wound.

Operation.—Having exposed the site of the wounded urethra by external incision _ a metal sound or soft catheter is passed through the urethra, using special care not to increase the wound. With fine chromic gut or fine silk, carried in a curved needle held in a holder, the opposite edges of the wounded urethra are united by interrupted sutures, passing through the lips of the wound _ except the mucous membrane. A soft catheter is worn for two or three days until time has been given for the shutting off of the wound from the interior of the urethra. The external wound is left open, being packed with gauze until the urethral wall has healed _ to avoid the danger of urinary infiltration.



Fig. 4848.—Repair of the Lacerated or Incised Bulbous Urethra by Tier Suturing _ I; _ a, Bulbocavernous muscle; _ b, corpus spongiosum; _ c, non-penetrating suture of the urethra; _ d, buried suture of corpus spongiosum; _ f, gauze drain down to the sutured urethra; _ e, suture of skin and bulbocavernous muscle.

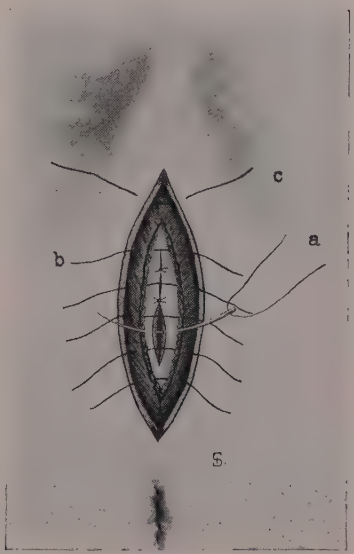


Fig. 4849.—The Same _ II; _ a, Suture of the corpus spongiosum; _ b, suture of the overlying bulbocavernous muscle and connective tissue; _ c, suture of the skin.

The technic of suturing the penile urethra is shown, under wounds of the urethra, in Fig. 4843.

The details of suturing the bulbous urethra are seen in Figs. 4848 to 4850.

The application of urethrorrhaphy is called for in many of the operations involving the urethra _ and is especially illustrated in wounds, and in some of the so-called plastic operations upon these parts.

In Fig. 4851 is seen a completely divided urethra sutured by interrupted catgut stitches which penetrate all the coats of the canal _ the site of suturing being safeguarded by means of a temporary drain carried down to the line of stitches.

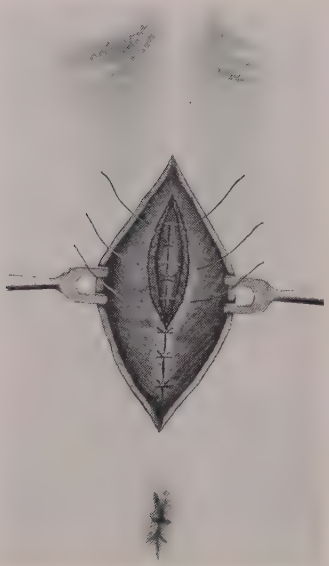


Fig. 4850.—The Same _ III; _ Suturing the split bulbocavernous muscle together _ both for the purpose of uniting its borders and to reinforce the sutured fibrous tunic of the corpus spongiosum.

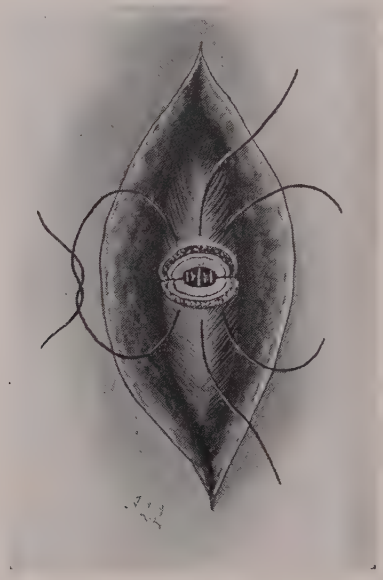


Fig. 4851.—Complete Circular Ureterorrhaphy Following Division of the Urethra; _ Through-and-through sutures of all the coats _ as an alternate method of circular suturing.

URETHROSTOMY

Description.—Making of a more or less permanent opening of the urethra in the perineum. Indicated where the anterior portion of the urethral canal is impermeable, as for stricture, _ or in case of amputation of the penis.

Preparation _ Position _ Landmarks.—As for median perineal section.

Incision.—Determined by the special circumstances of the case.

Operation.—The establishment of urethrostomy, following total amputation of the penis, is described and pictured under the latter title (see Index).

In performing urethrostomy in connection with an impermeably strictured urethra, and where the urethral opening is planned to be permanent, the strictured site of the urethra is exposed, as in the technic of external perineal urethrotomy (v. p. 668) _ the urethra is transversely divided, just behind the stricture, and its proximal end limitedly freed from its surroundings. This proximal end of the urethra is then axially slit for a very short distance upon its floor, or upon floor and roof _ and the lips thus formed by slitting are sutured into the skin of the perineum. The proximal end of the distal portion of the urethra is sutured up _ and the perineal wound is closed up to the margins of the implanted urethra (Fig. 4852).

In performing urethrostomy which promises to be but temporarily needed, the strictured site is exposed, as in the preceding technic, but instead of transversely dividing the urethra just posterior to the stricture and anchoring its squarely cut end into the perineum, an axial incision is made through the floor of the urethra, just behind the stricture, without dividing the continuity of the canal, and the lips of this axially incised urethra are sutured into the sides of the lower plane of the wound (not into the skin, Fig. 4853). The rest

of the perineal wound is closed, down to the site of the urethrostomy. Subsequently, if the continuity of the urethral lumen can be restored, the urethrostomy opening is closed by some form of plastic operation.

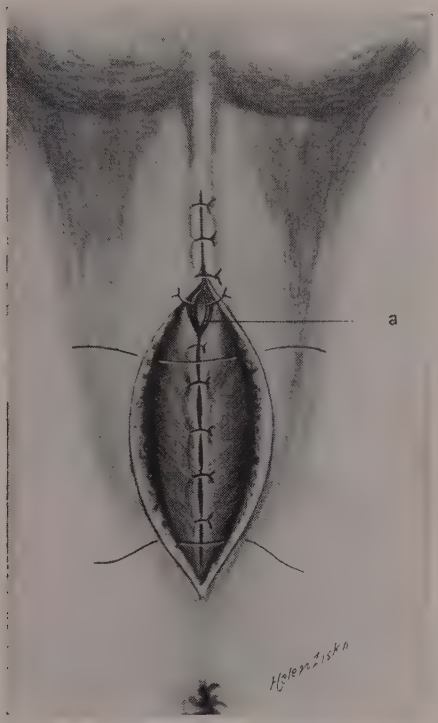


Fig. 4852.—Permanent Perineal Urethrostomy Following Transverse Urethrotomy; – The margins of the transversely divided urethra are sutured to the skin margins, as at a. The rest of the wound is closed throughout by deep and superficial stitches.



Fig. 4853.—Temporary Perineal Urethrostomy Following Axial Urethrotomy; – A catheter occupies the urethra. Sutures are seen anchoring the wall of the urethra into the wound, on a level with the spongy body. Sutures are also placed to close the ends of the wound only – the center being left open for drainage.

The site of the urethrostomy is usually the membranous urethra.

The patulousness of the urethra between the bladder and the urethral opening should be assured before anchoring the urethral opening or urethral end.

INCISION AND DRAINAGE OF PERIURETHRAL ABSCESSES AND OF AREAS OF URINARY INFILTRATION

Suppurations in the periurethral structures, whether in the region of the penile, scrotal, or perineal urethra, usually have their origin in the glandular structures opening into the urethra – bacteria getting into the glands from the urethra, and causing infection and rupture of the glands, with diffusion of the infective bacteria into the surrounding tissues. If the destruction of tissue involve the urethral wall, urinary extravasation of the neighboring parts, often very extensive, is added to the original infection. Infection, therefore, is generally the point of departure rather than urinary extravasation. And, indeed, periurethral infection occurs alone in many cases.

The courses which extravasated urine may take after its escape through a urethral opening will, owing to the peculiar anatomic arrangement of the structures, depend upon the site at which it escapes from the urethra _ and may be grouped as follows: _

(*a*) When the Urine Escapes from the Urethra in Front of the Anterior Layer of the Triangular Ligament it may infiltrate in either one of the following directions: _ Most frequently it ruptures the fibrous sheath of the penis, and passes into the scrotal connective tissue, and thence upward above the symphysis pubis, in the areolar tissue plane of the abdominal wall. Less frequently it remains, at first, within the fibrous sheath of the penis (the fibrous covering of the corpus spongiosum), and then works its way forward until



Fig. 4854.—Incision of a Periurethral Abscess of the Perineal Portion of the Urethra.

it reaches the back of the penis, between the corpora cavernosa _ and thence, traveling under the skin of the penis, extends toward the abdominal wall.

(*b*) When the Urine Escapes from the Urethra Between the Anterior and Posterior Layers of the Triangular Ligament: _ Owing to the junction of the two layers of the triangular ligament above, and the resistant barrier that the anterior layer presents anteriorly, and the posterior layer, posteriorly, the extravasated urine travels in the direction of least resistance _ which is toward the perineal surface. When this plane (the surface of the perineum) is reached, and if the perineal skin does not give away, or is incised, the urine may infiltrate the ischiorectal fossæ, or pass laterally as far as the ischial tuberosities, or even to the femoral trochanters.

(*c*) When the Urine Escapes from the Urethra Behind the Posterior Layer of the Triangular Ligament: _ The extravasated urine tends to pass into the

pelvis, dissecting the perirectal tissues, the space of Retzius, and the perivesical tissues _ even sometimes rupturing into the peritoneum.

The same routes may be followed by pus originating in the same sites _ or by a combination of pus and urine.

If, in its progress, exit for these fluids be spontaneously made in the overlying skin the further extravasation will be somewhat modified upon the principle of a safety outlet.

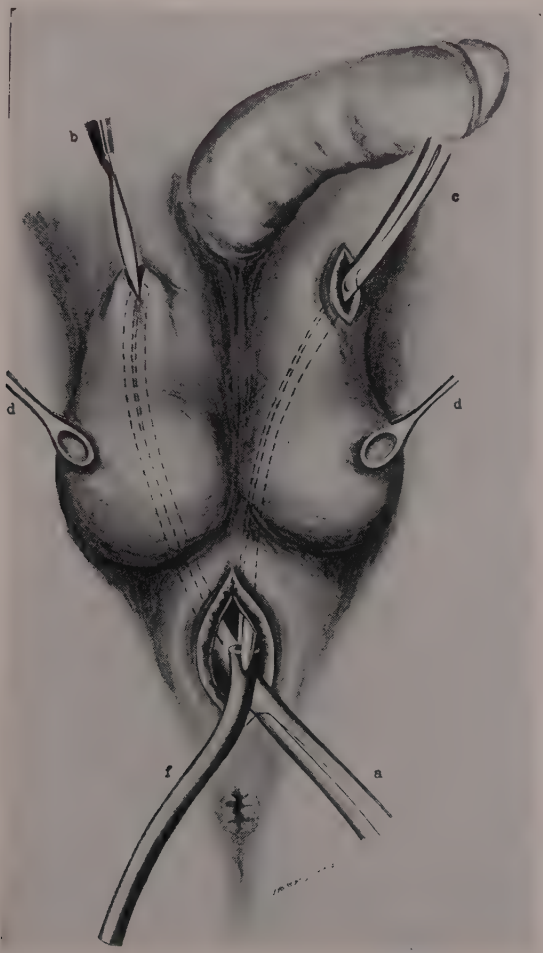


Fig. 4855.—Puboperineal Drainage in Extensive Periurethral Infiltration or Suppuration: _ a, Slender, curved dressing forceps carried through the perineal incision, upward along the posterolateral aspect of the scrotum; _ b, incision in pubic region made between tips of slightly separated blades of dressing forceps. The drainage-tube may be drawn from above downward through this opening. Or, c, forceps may be introduced downward through the pubic opening, when made, and draw the drainage-tube from below upward; d, d, testes held upward.

But the invariable indication is immediate incision of the site in which suppuration or urinary infiltration has occurred to lessen the destruction to the parts _ which is often very great and very rapid. The repair, if possible, of the source from which pus or urine has come is the immediately next important indication.

The mere incision of a septic phlegmon or the site of a urinary extravasation is relatively simple, as compared with the problems which often arise as to dealing with the complications encountered as a result of the destruction accomplished prior to incision – and as to providing for satisfactory drainage of the infected regions – to say nothing of the sometimes required necessity of conducting the urine from the bladder by retention catheter along a route where the urethra has been partly destroyed.

The details, therefore, of dealing with each case will differ with the nature of the special case – and only a few generalities will be mentioned and pictured here.

The incision of a periurethral abscess of the penile portion of the urethra, in which no considerable infiltration of pus or urine has occurred, is comparatively simple. Its incision is usually made axially at the region of most marked fluctuation – or in a position leading most directly to the site of original involvement.

In opening perineal abscesses of periurethral origin the incision is invariably made in the median line (Fig. 4854) – and subsequently extended as indicated.

In providing for drainage fenestrated rubber tubing of large caliber is probably the most useful drain – and it is of especial importance that these drains should pass to the limits of the infected regions – which are sometimes very far distant from the perineal opening. So long are some of the tracts to be drained that counteropenings are indicated where it is possible to make these. Extensive drainage of the puboperineal region is shown in Fig. 4855.

Where part of the urethra has been destroyed by the combined processes of infection and urinary infiltration a soft retention catheter is carried into the bladder from the meatus, so that, in the granulation of the parts, a new straight canal can be molded around the catheter.

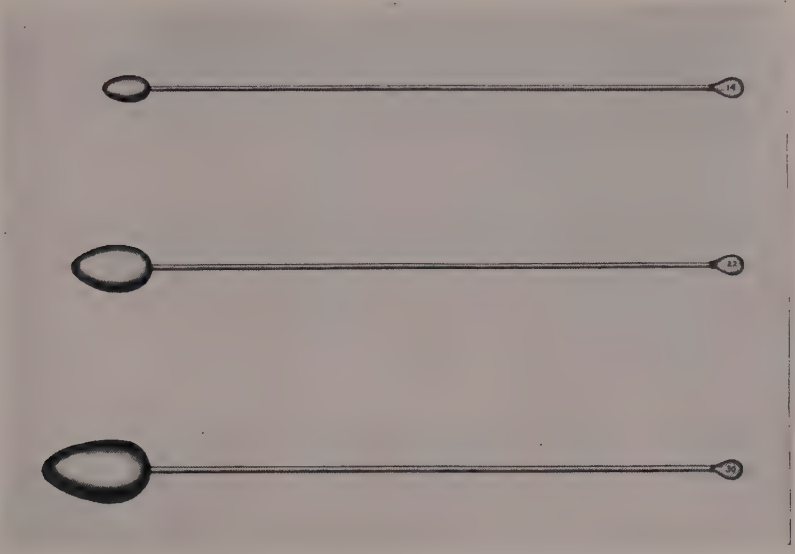
It is unnecessary to say that any operation for the relief of such conditions as just described should also include the removal of the cause of the condition immediately or as soon as possible – when that cause is still persisting – such, for instance, as a tight stricture.

INSTRUMENTAL LOCALIZATION OF URETHRAL STRICTURES

It is desirable to know the position, extent, and number of strictures in advance of undertaking any operative procedure for their relief. Several different means are available to these ends.

Localization of Urethral Strictures by Graded Bougies à Boule.— Bougies à Boule are of different sizes, corresponding with the calibration of sounds (Figs. 4856–4858). An instrument is first chosen of the maximum size which will comfortably pass the meatus. This is passed down the urethra until arrested by the stricture – when it is replaced by successively smaller ones – until one is found that will just pass through the strictured site. After it has passed through the stricture it is withdrawn until its shoulder presses the posterior face of the stricture (Fig. 4859). While steadied in this position its shaft is slightly bent (not extremely, as shown in the above picture) exactly at the orifice of the meatus – thus determining the distance of the posterior face of the stricture from the meatus (Fig. 4860, the distance **a–c**). The bulb of the instrument is felt to jump, as it were, as it is drawn outward through the stricture. After the instrument has been withdrawn through the region in which it is felt to be grasped, but before it is entirely withdrawn from the urethra, it is pushed downward again, until the tip of the bulb is felt to be arrested against the anterior face of the stricture, when its shaft is again

slightly bent exactly at the meatus – thus giving the distance from the meatus of the anterior face of the stricture (v. Fig. 4860, the distance **a–b**). But



Figs. 4856–4858.—Bougies à Boule; – Small, medium, large.

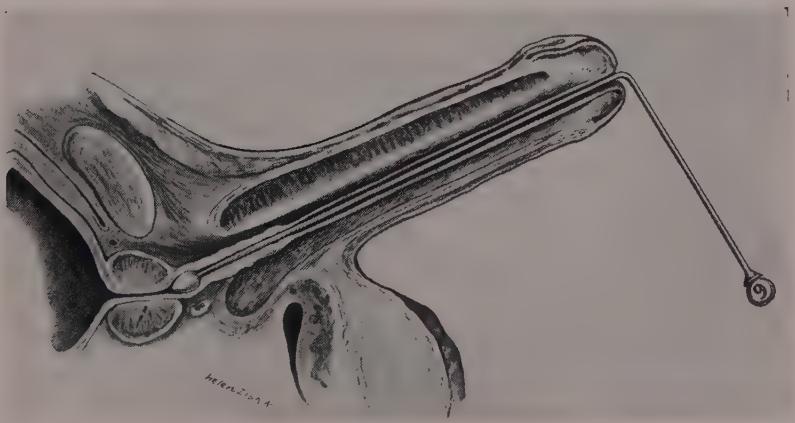


Fig. 4859.—Locating the Position and Extent of Urethral Stricture by Means of a Bougie a Boule – I; – The sound has been passed beyond the stricture, then withdrawn until its shoulder engages against the posterior limit of the stricture – the distance of the posterior limit from the meatus being marked by crooking the sound at the meatus. It is now drawn out, forward, beyond the stricture, and then pushed back against it, until its tip engages the anterior face of the stricture – when the sound is again bent at the meatus. The distance of the beginning and ending of the stricture from the meatus is thus marked by the anterior and posterior bends – and its extent is equal to the distance between the two angulations made in the instrument (v. Fig. 4860.)

when smaller calibered strictures lie posteriorly to an anterior stricture which has been located, smaller bougies, in turn, must be employed in locating them.

Should it happen, however, that the more anterior of two strictures is smaller in caliber than the more posterior, the latter will not be felt by a bougie small enough to pass through the former — nor is the method by bougies à boule available if the stricture is too small for the smallest instrument to pass. The method, nevertheless, is the most generally employed of any.

Localization of Urethral Strictures by Urethrometer.—Various types of instruments are used — the Otis urethrometer being shown in Fig. 4861. The principle of its usage is very similar to that of the bougies à boule. The

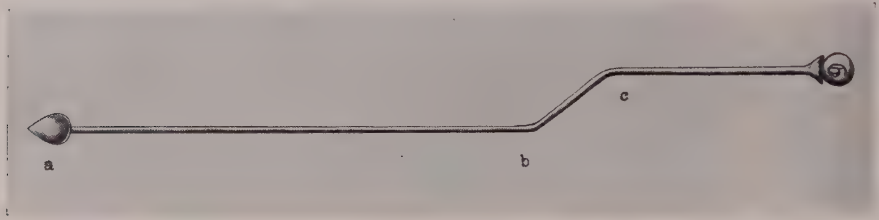


Fig. 4860.—The Same — II: — **c**, First bending equals distance from meatus to posterior limit of stricture, in the preceding picture; — **b**, second bending equals distance from meatus to anterior limit of stricture (when the sound is carried backward the second time, against the anterior face of the stricture); — **b–c** equals the extent or length of the stricture.

distensible blades, covered by a freshly tested rubber cap employed to prevent wounding the mucosa, are closed and the instrument passed down to the bulbo-membranous urethra — the handle is then turned, the blades expanded, and the instrument is withdrawn until the expanded portion is pressed against the posterior face of the stricture — when this distance is recorded on the dial. Not only is the posterior face of the stricture thus located — but the caliber of the stricture itself is recorded, as the instrument passes through it. Having traversed the stricture, it is again pushed backward until its expanded blades are in contact with the anterior face of the obstruction, and its distance from the meatus noted on the dial.



Fig. 4861.—Otis' Urethrometer — with articulated tips and dial.

Localization by the Endoscope.—The localization of strictures by endoscopy, and the securing of knowledge concerning them, is limited. In the formative stage of a stricture the nature of its wall can be ascertained. The face of the stricture can be examined. And if the strictural opening be eccentric, this fact can be ascertained.

Localization by Means of Sounds, Olivary Bougies, and Filiform Bougies.—The use of sounds and olivary bougies has been considered (v. p. 620). The use of filiform bougies will be described at p. 652.

URETHROTOMY, IN GENERAL. STRICTURES OF THE URETHRA

Description.—Urethrotomy consists in the incision of the urethra, usually in its long axis.

Varieties of Urethrotomy.—Internal urethrotomy, External urethrotomy.

Internal Urethrotomy.—Axial, linear division of a strictured urethra from within the canal _ by means of a special instrument, a urethrotome, introduced into the canal through the meatus. The concealed knife-blade cuts through the stricture, but not through the entire urethra. Where simultaneous dilatation is indicated, a dilating urethrotome is employed. The blade which makes the incision is only sprung into cutting prominence while passing through the actual stricture, as instrumentally determined, in the way to be described. Internal urethrotomy should be confined to the penile and scrotal portions of the urethra. By some it is applied as far backward as the bulbomembranous junction _ and by others it is limited to the first 12.7 cm. (5 inches) of the urethra. Internal urethrotomy of the deep urethra is apt to be followed by concealed hemorrhage, the blood passing into the bladder _ and, also, infection is more apt to occur in the internal division of the membranous urethra. Various views exist as to the urethral wall to be incised. Probably the majority hold that the division should be made in the roof of the urethra. Others hold it of less importance as to whether the incision be made in the roof or floor of the urethra _ and some urethrotomes have blades which are projected to incise the roof of the canal, and the blades of others are so projected as to cut the floor. Horwitz states that a large-calibered stricture, anywhere from the meatus to the bulb, which is going to be treated by internal urethrotomy, should be incised upon the urethral floor; _ and that small-calibered strictures should be incised along the roof of the urethra, except that those at the bulbomembranous junction, or in the membranous urethra (when internal urethrotomy is performed that far back) should be made in the floor of the canal (as fatal hemorrhage has occurred in making the division in the roof by dividing the dorsal vein of the plexus of Santorini). Internal urethrotomy may be made from before backward (cutting from the anterior to the posterior limit of the stricture) _ or from behind forward (cutting from the posterior to the anterior limit of the stricture).

External Urethrotomy.—Axial, linear division of a strictured urethra from without inward. External urethrotomy is indicated: _ (*a*) In impermeable strictures anywhere and everywhere in the urethral canal _ for, naturally, if they cannot be passed *via* their lumen, they can only be approached by division from without; _ (*b*) All strictures, whether permeable or not, at or posterior to the subpubic ligament.

Several grades of permeability of the urethra may exist _ calling for external urethrotomies of differing grades of severity and complication. These grades of stricture and the measures for their relief by external urethrotomy will be considered in the order of their simplicity of nature, as well as simplicity of surgical relief _ from the less to the more complex.

(*a*) A grooved staff can be passed entirely through the strictured urethra _ and upon this the stricture is divided _ constituting External Perineal Urethrotomy upon a grooved staff, or Syme's operation.

(*b*) A grooved staff cannot be passed, but a filiform guide can be introduced through the stricture into the bladder, and over this guide Gouley's tunneled grooved sound can be carried down to the stricture _ but not through it _ and upon this the upper end of the stricture is exposed _ and then the filiform

is followed as far toward the bladder as necessary, and the stricture divided _ External Perineal Urethrotomy upon a filiform guide, or Gouley's operation.

(*c*) A grooved staff cannot be passed through the stricture _ nor can a filiform be passed through _ but a grooved staff can be passed down to the stricture (not through it) _ and upon this the urethra is opened just in front of the stricture (to the meatal side of the stricture) _ after which a fine grooved director is passed along the canal toward the bladder, and the stricture divided upon it _ External Perineal Urethrotomy upon a grooved staff passed down to the stricture, followed by section of the stricture by a grooved guide carried through it, or Wheelhouse's operation.

(*d*) Neither a grooved staff nor a filiform can be passed through the stricture _ the urethra being, practically, impassable to instruments of all kinds _ therefore, no attempt is made to use any form of guide _ but the urethra is axially incised by the sense of touch and known anatomic relations, posterior to the stricture, and immediately anterior to the prostate gland _ giving relief to the bladder, and leaving the strictured urethra to be subsequently treated _ constituting External Perineal Urethrotomy, without a guide, or Cock's operation.

Methods of Treating Urethral Strictures.—Dilatation _ divulsion _ meatotomy _ internal urethrotomy _ combined internal urethrotomy and divulsion _ external urethrotomy _ excision of the stricture.

Indications for Surgical Treatment of Urethral Strictures.—The presence of phenomena, in a broad sense, detectable by patient, or Surgeon, of sufficient narrowing of the urethra to noticeably interfere with comfortable urination _ as the early detection of such phenomena, and the use of graduated dilatation, employed at intervals will usually avoid more serious operative measures. It is difficult to otherwise answer, specifically, the question of what constitutes urethral stricture _ or what constitutes the exact date for beginning surgical measures for its relief.

Choice of Operation for Urethral Stricture.—Dilatation of the urethra, by graded instruments, at regularly repeated intervals will succeed in the majority of cases of all uncomplicated stricture. It should usually be the first measure tried. In some cases, however, dilatation cannot be carried out, or no progress be made under its use. In other instances dilatation will be successful up to a certain point, beyond which no further progress can be made _ after which it may be indicated to cut the stricture before proceeding with the dilatation.

Meatotomy is indicated in stricture situated at or very near the meatus.

Divulsion is an uncontrollable method of procedure which is not to be recommended.

Internal urethrotomy, where operative measures are required, is indicated in strictures of the penile and scrotal urethra _ and is usually performed upon the roof of the canal.

Internal urethrotomy, accompanied by simultaneous dilatation by the separated blades of the instrument is not open in indicated cases to the objection of simple, blind divulsion, which splits the urethra in no predetermined direction.

External urethrotomy is indicated in strictures of the bulbomembranous urethra _ and is performed by median perineal section.

Unless urethrotomy, internal or external, be followed by the passage of sounds, the stricture will re-form.

In a very large proportion of cases _ in the majority, according to some _ a condition of multiple rather than of single stricture exists.

Excision of the strictured portion of the urethra is sometimes indicated

where the stricture is single and limited, and dense in structure. Following the excision the severed ends of the urethra are united by suture, if possible – or if not, are anchored as near to each other as possible.

Anesthesia – Analgesia – in Operating for Stricture of the Urethra.—Analgesia is usually employed in internal urethrotomy – 1 per cent. novocain solution, with 1 drop of a 1 : 1000 adrenalin solution added for every 2 c.c. of the solution. Anesthesia (gas and oxygen, particularly) is generally used in external urethrotomy – though spinal or sacral analgesia are sometimes chosen – as well as massive infiltration of the perineal region.

The bladder is kept partly full in all urethrotomy operations, especially those made by external section – in order that entrance to it may be recognized by the escape of fluid.

For the anatomy involved in the perineal operations see the description of Median Perineal Cystotomy, p. 550.

Varieties of Urethral Stricture.—Strictures occur in the male and in the female. They may be congenital (rarely), or acquired (usually). They may be temporary, when they are either spasmodic, or inflammatory – or they may be permanent, when they are organic and due to pathologic changes in the urethral wall, cell proliferation occurring either in the wall or around the wall. Organic strictures result either from inflammation or from traumatism – and are usually the result of gonorrhea (the most frequent cause), chancre, tuberculosis, and sometimes tumor.

Clinically, the following forms of stricture may be encountered: – single – multiple – bridle (in the form of a membranous band) – annular (encircling the urethra) – recent, or soft (where cell infiltration has not become fully organized) – resilient, or recurring (recontraction following dilatation) – irritable (where catheterization is followed by pain, hemorrhage, or temperature, irrespectively of asepsis) – permeable (where an instrument may be passed) – impermeable (where no instrument can be passed) – cicatricial (of fibrous or cartilaginous quality) – centric (where the opening is in the anatomic center of the canal) – eccentric (where the opening is nearer roof, floor, or side) – small-calibered stricture (in which no instrument smaller than No. 5 French can be passed) – large-calibered stricture (in which instruments larger than No. 5 French, can be passed).

Preparation for Operation Upon Urethral Strictures.—If the urethral canal can be irrigated, this should be done – by solutions which, while antiseptic, are not strong enough to be irritating – such as boric acid solution, 4 per cent. – permanganate of potassium solution, 1 : 4000 – argyrol solution, 2 to 5 per cent. – or even normal saline solution. It is well to use the irrigant in advance of operating and immediately at the end of the operation – and some employ it after the first urination or two. It is also well to administer $7\frac{1}{2}$ gr. of hexamethylenamin (urotropin) three times daily, for a few days before and after the operative procedure.

Following the passage of instruments some Surgeons make an instillation of 1 : 1000 nitrate of silver solution.

Position of the Patient.—The patient is in the dorsal recumbent posture, with separated thighs, for passage of instruments and for intra-urethral operations, as well as for extra-urethral operations of the penile portion of the urethra. For the operations of external urethrotomy, performed through the perineum, the lithotomy position is generally employed.

TREATMENT OF URETHRAL STRICTURES BY DILATATION

Dilatation of the strictured urethra is equivalent to stretching the urethra at the site of stricture by means of an instrument of fixed or variable caliber

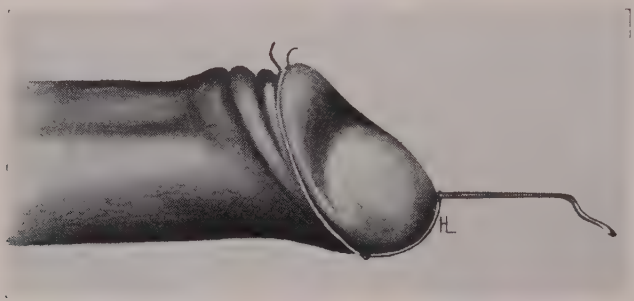


Fig. 4862.—Tying In a Filiform Dilator by Means of a Loop Passed Behind the Glans Penis.



Fig. 4863.—Passage of Several Filiforms Simultaneously Through the Strictured Urethra

introduced through the meatus. The largest number of strictures are treated by dilatation and the majority cured thereby. Several methods of practising dilatation are in use.

Gradual Dilatation — is accomplished by the passage of increasing sizes of graded instruments — at intervals, until the normal size of the urethra is reached, or even passed. It is the method of choice.

Rapid Dilatation — is the rapid stretching of the strictured urethral canal by the successive passage, at the single sitting, of instruments of increasingly large size. The method is not generally approved.

Intermittent Dilatation — dilatation with increasingly calibered sounds, practised at intervals of from three to five days — and is the method, as to the time element, which is usually carried on in conjunction with gradual dilatation.

Continuous Dilatation — a modified form of continuous dilatation is practised when a whalebone bougie is tied into the urethra for upward of an hour. Continuous dilatation, however, usually consists in passing a urethral catheter into the bladder and anchoring it in position for twenty-four hours — during which time it both dilates the strictured site and empties the bladder — and this method is not usually considered desirable.

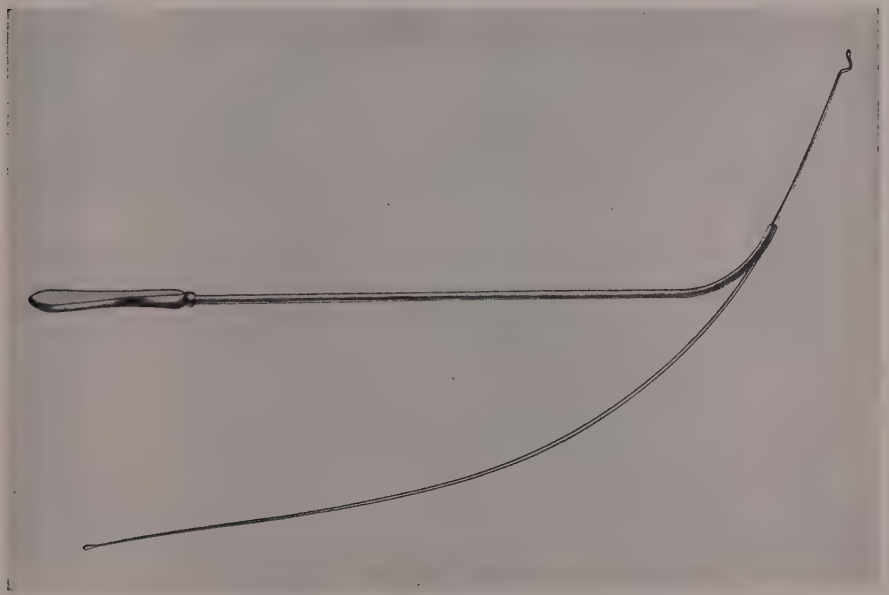


Fig. 4864.—Gouley's Tunneled Sound with Filiform Guide Threaded Through Its Terminal Tunnel.

Technic of Gradual, Intermittent Dilatation.—The instruments employed in this form of dilatation are — whalebone filiforms and metallic followers pliable, woven bougies; olivary bougies; graded, conical sounds; urethral dilators.

The passage of sounds has been described and pictured in detail (v. pp. 620–626).

It will be supposed that a stricture of the bulbomembranous urethra of filiform size is under consideration — a type of case which will fairly cover the average range of technic in dilatation. The fact that the start at the actual dilatation is made with the filiform is demonstrative that no larger instrument, upon trial, will pass — otherwise, the beginning would be made with the largest instrument that will traverse the stricture. A straight filiform is taken between the thumb and first finger of the right hand, and is carried

through the meatus and down the urethra, until arrested. When its further progress is stopped various maneuvers are practised – the filiform is twisted between the fingers, in boring fashion – it is withdrawn a short distance, and then pushed back against the anterior face of the obstruction. If the straight-tipped filiform will not pass, one with an angular or spiral tip is substituted, and the effort again made – and is often successful, especially in an eccentrically placed urethral lumen, into which the deviated tip of the second filiform often readily engages. If a single filiform passes, and



Fig. 4865.—Dilatation of Urethral Stricture by Gouley's Tunneled Sound Passed Through the Urethra Upon a Filiform Guide.

especially if it is shown, by the tightness of the grip, that it is held in a very small-calibered stricture, it may be anchored in the meatus (Fig. 4862) for part of an hour – by the end of which time it may be found much less tightly held – in other words, that some distinct dilatation has been already accomplished. At times the first filiform, straight, angular, or spiral, will not pass through the stricture. When this is the case it will often happen that if two or three additional filiforms be passed, each as far as it will go, and then, in alternation, each be picked up in turn, always beginning with the more

advanced one, that eventually one or two of them will be passed on through the constriction as shown in Fig. 4863.

Once the filiform guide has passed into the bladder, the tunneled follower (Fig. 4864) is slipped over the filiform, and, guided by it, is passed upon it on down through the strictured urethra (Fig. 4865). While passing the tunneled sound over the filiform guide, the distal end of the filiform must be firmly held, under even tension, against the onward push of the follower – else the filiform may buckle, and break. It rests with the judgment of the Surgeon as to whether he passes down a small or a medium size of tunneled sound upon the guide. The passage of the tunneled sound upon the filiform and held in position for a few minutes, for the purpose of dilatation, should suffice for the initial step of opening up the stricture.

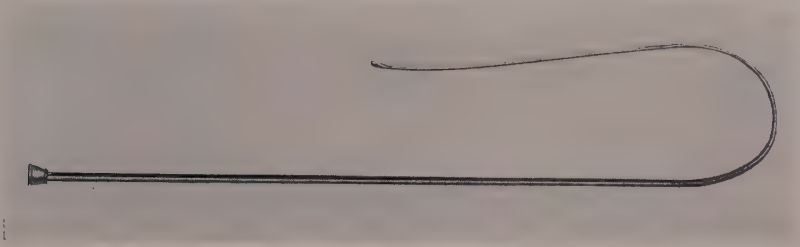


Fig. 4866.—Harrison's Urethral Whip Bougie.

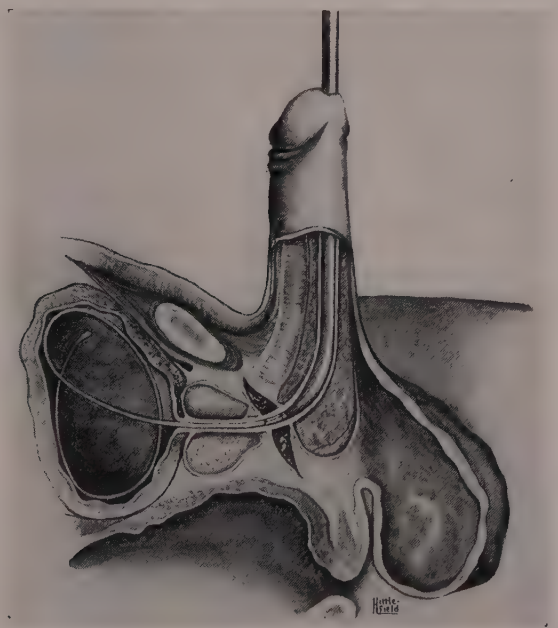


Fig. 4867.—Dilatation of Urethra with Whip Bougie and Attachable Sound.

Other kinds of filiforms are employed. In Harrison's whip bougie, for instance (Fig. 4866), the filiform portion and the part of larger caliber are continuous – the latter being pressed on through the stricture after the former

enters the bladder and coils up within it. This form of whip bougie is also made so that after it has passed the stricture and entered the bladder the sound may be screwed onto it — and, itself, be pushed through the stricture (Fig. 4867). Or, instead of using whip bougies, solid or attachable to each

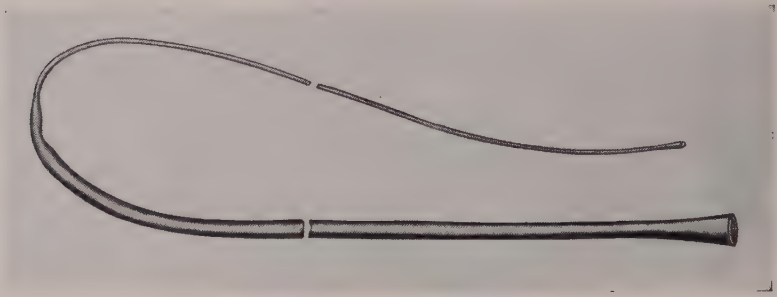


Fig. 4868.—Phillip's Whip Catheter.

other by a screw junction, whip catheters may be used, whose entry into the bladder is revealed by the flow of urine. These may be in one piece (Fig. 4868), or attachable (Fig. 4869) — and pliable throughout, or partly metallic.

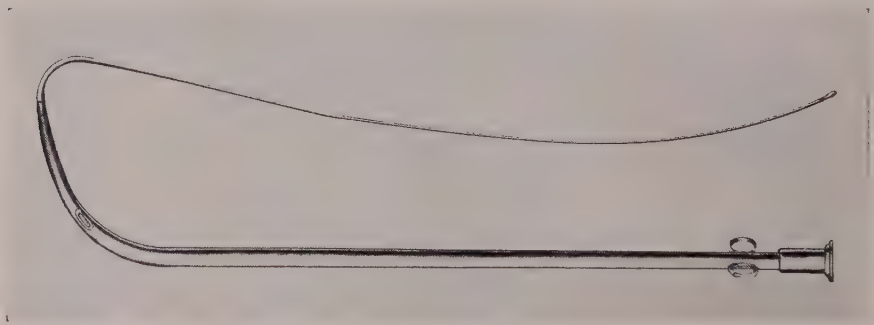


Fig. 4869.—LeFort's Metallic Male Catheter with Filiform Guide.

It is best not to attempt to make too rapid progress. If no necessity for evacuating urine be present, or other emergency, from three to five days are allowed to pass before another instrumentation — and at the second, and

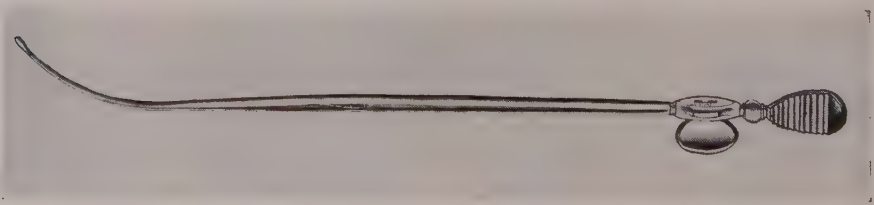


Fig. 4870.—Thompson's Urethral Dilator.

often at the third séance — no effort is made to progress materially further than at the first passage — or but very little. Subsequently, however, sounds of increasing size are passed at intervals ranging from three to seven days, according to circumstances — proceeding very gradually in the process of

stretching — and always beginning each dilatation by an instrument of smaller size than the maximum used at the preceding sitting. The technic of passing sounds is described at p. 620.



Fig. 4871.—Gouley's Urethral Dilator.

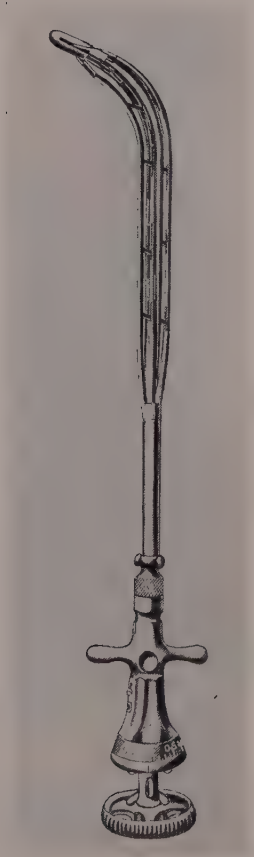


Fig. 4872.—Kohlmann's Urethral Dilator with Van Buren's Curve — for the posterior and part of the anterior portion of the urethra.

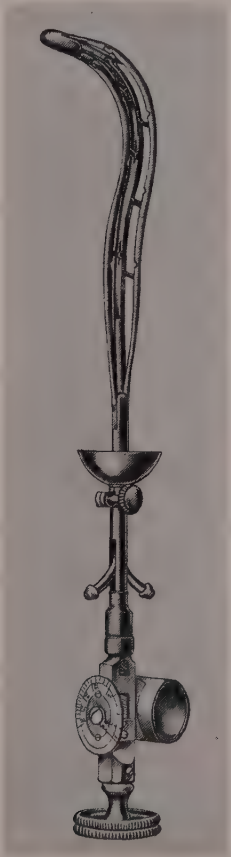


Fig. 4873.—Frank's Irrigating Urethral Dilator with Guyon's Curve — for the posterior and part of the anterior portion of the urethra.

Sometimes the initial passing of the filiform is accomplished through the tube of a urethroscope.

The dilating instrument may be allowed to remain *in situ* for a few minutes — to accomplish the effect of pressure upon the walls of the stricture.

Instead of following up the initial dilatation of the stricture by sounds of increasing size, special types of dilators are often employed. A variety of these is seen in Figs. 4870 to 4874 _ and the general method of their application in Fig. 4874. Their use may be assumed at some intermediate stage of the treatment.

Whether by the use of graded sounds or special dilators the canal is continued to be stretched at intervals, until if the type of stricture present will admit it, its lumen is brought up to the normal _ and after that dilatation may be continued at intervals, measured now by months instead of days.

Technic of Rapid Dilatation.—Consists of rapid stretching of the strictured portion of the urethra. This is accomplished in one of two ways _ either

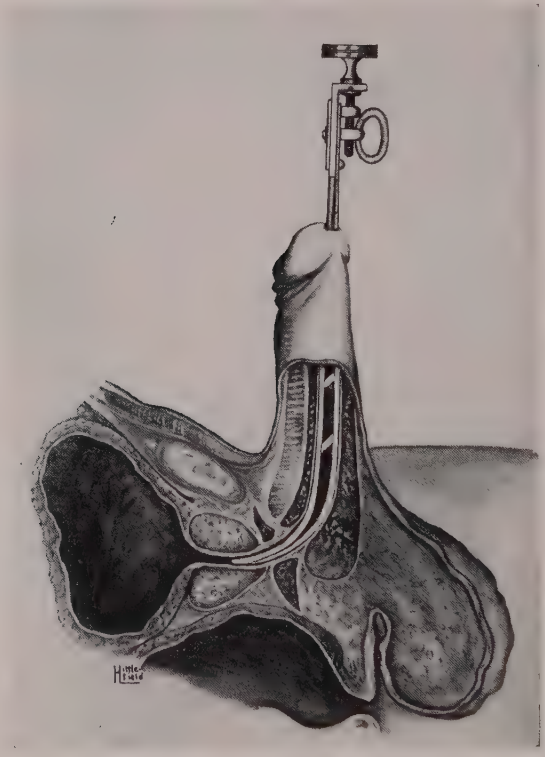


Fig. 4874.—Dilatation of Constricted Urethra with Oberlaender's Urethral Dilator

by the passage of successively larger sounds at the same sitting _ or by the use of one of the dilating forms of instruments, such as those already pictured. The narrowed canal may yield very rapidly _ but generally at the cost of considerable traumatism _ and often with very marked and unfortunate reaction. If the dilatation goes on to rupture of the urethra, which it sometimes does, the technic then becomes that of divulsion (v. p. 659). Rapid dilatation, therefore, is, on general principles, to be deprecated.

Technic of Continuous Dilatation.—Consists of anchoring (tying in) the largest size catheter which will pass through the stricture and enter the bladder _ and letting it remain in, usually twenty-four hours _ at the end of which time it is replaced by a still larger catheter _ and so on, until the normal urethral calibration is reached or a reasonable trial has been made.

All in all, the method is not to be advised, as marked irritation and infection are apt to occur.

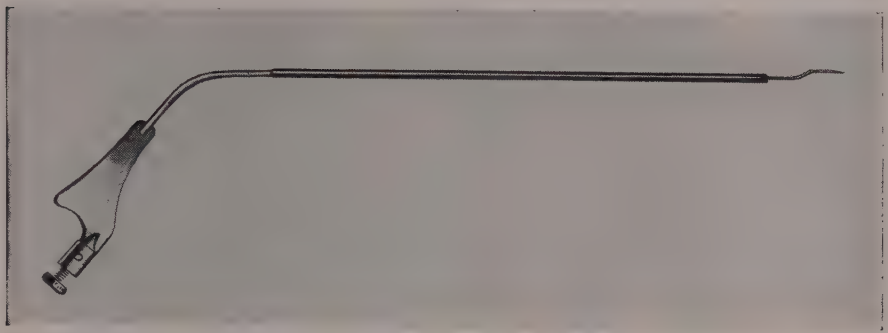


Fig. 4875.—Kollmann's Sharp-pointed Stricture Electrode for Use Through an Endoscope.

Treatment of Stricture by Electrolysis.—Such an instrument as is sometimes employed in this procedure is seen in Fig. 4875.

TREATMENT OF URETHRAL STRICTURES BY DIVULSION

Rupture of the stricture by intra-urethral instrumental dilatation. This, in common with all methods of instrumental bursting, *versus* deliberate cutting, is uncontrollable in degree and direction of action – and, hence, unsurgical – as long as other better means are available.

In the procedure the stricture is split open in any and unknown direction, and this may be accomplished by the forcible passage of rapidly increasing sounds, or by some form of dilating instrument, with separable blades. Any dilator, intended for legitimate purposes, may be made to divulse or rupture the strictured urethra by being brought into extreme action.

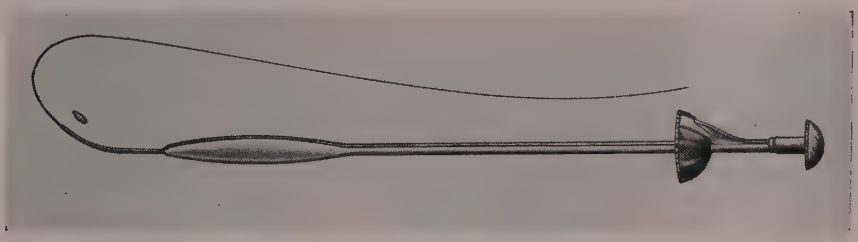


Fig. 4876.—Bigelow's Urethral Divulsor.

A characteristic type of divulsor, however, is Bigelow's (Fig. 4876) consisting of a filiform portion, which passes through the stricture – and the divulsor, which slips down over this filiform guide, or is forcibly pushed down over it – and ruptures its way thrugh the constriction by tearing the wall of the stricture – and sometimes that of the urethra.

MEATOTOMY

Description.—Incision of the external urinary meatus – for the purpose of increasing the size of the urethral opening – and is indicated in contracted meatus, and in those cases where it is necessary to pass an instrument of larger diameter than the uncut meatus will accommodate.

Preparation _ Position.—As for internal urethrotomy (v. p. 662) _ of which it is a variety.



Fig. 4877.—Incising a Contracted Meatus Upon a Grooved Director _ the incision being median, and through the floor of the urethra.

Operation.—The enlarging incision is always made in the median line _ and in the floor of the urethra. Several methods of accomplishing this are available:

Meatotomy, upon a grooved director (Fig. 4877): _ The penis is taken in the fingers of the Operator's left hand _ the lips of the meatus are parted by the index and thumb _ a grooved director is passed a short distance into the urethral canal, with its groove downward _ and along this groove, with its cutting edge downward, a probe-pointed bistoury is carried, through and just beyond the meatus _ after which a median incision is made in the floor of the urethra, to the minimum extent which will enable the object to be

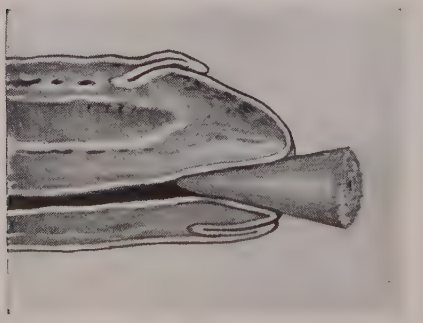


Fig. 4878.—Conical Gauze Plug Inserted Into the Incised Urethra to Keep the Raw Lips from Re-uniting.

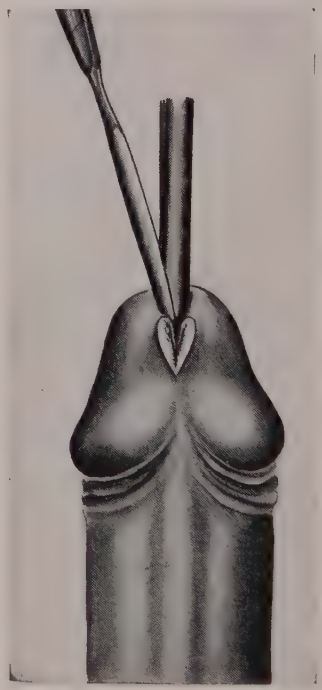


Fig. 4879.—Meatotomy by Means of a Probe-pointed Bistoury Introduced Upon a Sound _ I; _ The probe-pointed knife has been introduced alongside of the sound, and is in the act of cutting from within outward.

accomplished _ increasing the size of the meatus to the desired dimension, if on trying to pass the requisite sound the original cutting be shown to be inadequate. The lips of the wound, until healed, are generally kept apart by a strip of gauze _ or a small conical gauze plug (Fig. 4878).

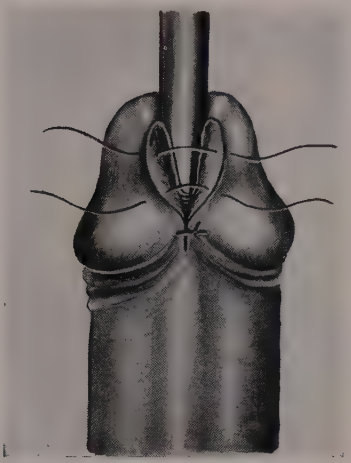


Fig. 4880.—The Same _ II; _ The meatus is then dilated by a larger sound _ after which the incised wound is so sutured as to insure a larger caliber _ the sutures including, if necessary, only a part of the thickness cut.



Fig. 4881.—Meatotomy _ after dilating the urethra by wire speculum.

Meatotomy, upon a urethral sound (Fig. 4879): _ The sound is first carried a short distance into the urethra, and, alongside of it, a narrow knife is passed, preferably a probe-pointed bistoury _ after which the meatus is enlarged to the desired extent in the act of withdrawing the knife. An alternate method is to cut down directly upon the sound from the outside _ at some cost to the edge of the knife. Following the section of the meatus and

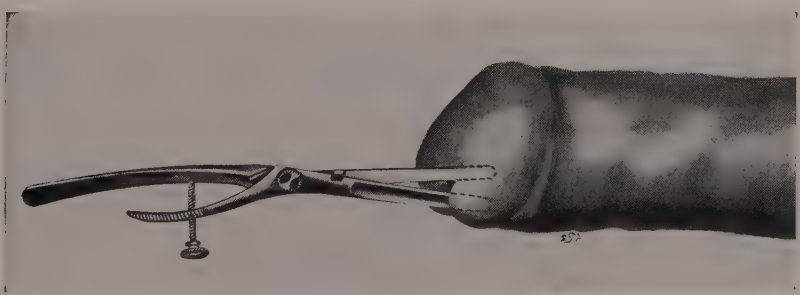


Fig. 4882.—Meatotomy _ with Gouley's meatotome.

the passage of a large instrument, it is sometimes shown that the resulting opening is unnecessarily large _ in which case part of the incision may be sutured either in its entire thickness _ or, as shown in Fig. 4880, in its superficial part.

Meatotomy through a bivalve or fenestrated urethral speculum (Fig. 4881): _ A wire speculum is usually employed, its blades opening laterally

_ and, between the separated blades, a probe-pointed bistoury is carried, and cuts its way from within outward.

Meatotomy by means of a meatome (Fig. 4882): _ The lower aspect of the lower blade of the meatome alone cuts. The instrument is introduced closed, the upper, dull blade preventing the lower, sharp one from cutting, as long as they are in contact. When the instrument has been introduced far enough, the blades are separated as far as indicated _ and the floor of the meatus is cut in the act of withdrawing the separated blades.

INTERNAL URETHROTOMY FROM BEFORE BACKWARD—FOR STRICTURE OF THE URETHRA

BY MAISONNEUVE'S SIMPLE URETHROTOME

Description.—The general features of internal urethrotomy have been given under Urethrotomy, in General, p. 649. The operation consists in the division of the strictured urethra from within the urethra _ by means, in the present instance, of a simple (that is, non-dilating) type of instrument _ Maisonneuve's urethrotome (Fig. 4883) _ cutting the stricture in its downward passage from before backward. The instrument consists of three parts: _ a staff of small size (No. 8, of the French scale), having a groove the entire

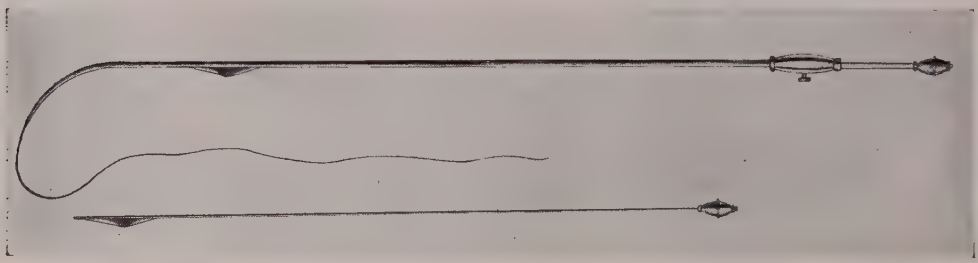


Fig. 4883.—Maisonneuve's Urethrotome and Guide, with Whip Guide; _ The apex of the triangular blade is flat and dull.

length of its concave aspect, and ending with a screwed-on bulbous tip, thus enabling the staff to be used alone; _ a whip bougie, which may, or may not be screwed, by its female screw, to the male screw on the end of the staff, after unscrewing the bulbous tip; _ a straight, pliable metallic rod, to pass down the concave staff, and armed with a triangular knife blade, sharp anteriorly and posteriorly, so as to cut an obstacle directly in front of it, either going, or coming, but wide, smooth, and blunt along that aspect which passes in contact with the urethral wall, and which, therefore, it does not cut.

Preparation.—It is desirable to know the position and calibration of the stricture or strictures to be dealt with in advance of the operation _ information which may be sought in the manner described under Internal Urethrotomy from Behind Forward, p. 665. In dividing the stricture from before backward, however, the necessity is not quite so great, as desirable as it may be. But to know, in advance, that the filiform and staff portions of the instrument will pass through the strictured site is absolutely necessary _ for, without this, the cutting blade cannot be made to traverse and divide the stricture.

The urethra is irrigated with a weak antiseptic solution. Anesthesia is usually to be preferred _ but instillation of cocain, novocain, or eucain solution, with adrenalin may also be employed.

Position.—The patient is recumbent at the edge of the table _ the Surgeon standing to his left.

Landmarks.—Such data as may have been previously secured through urethrometer, or by bougie à boule; the anatomy of the part.

Operation.—If the stricture be larger than No. 8 French scale, the bulb end is screwed upon the staff, which is then used without the whip attachment _ the staff being carried down to the prostatic urethra. If the stricture be smaller than No. 8 French, then the whip is screwed onto the end of the staff _ and the whip filiform lubricated is slowly passed through the strictured urethra, using especial care lest the pliable whip curls up in front



Fig. 4884.—Internal Urethrotomy with Maisonneuve's Urethtotome _ I; _ Surgeon, here on patient's right _ Assistant, steadying cannula. Surgeon's left hand drawing the penis upward upon the instrument _ while his right hand presses the urethrotome blade downward, through the strictured portion of the urethra. (Modified from Legueu.) Also see text for other positions.

of the stricture. The filiform or pliable guide is thus passed through the entire length of the urethra, until it coils up within the bladder _ and the end of the attached grooved metallic staff rests in the membrane-prostatic urethra. The straight, pliable staff, with the triangular knife-blade end, also lubricated, is inserted into the curved staff which has been introduced into the urethra, down to the bladder. While the Surgeon holds the grooved staff in his left hand, at an angle of about 45 degrees to the horizontal, and the knife staff in his right, an Assistant draws the penis up over the instrument _ while the knife blade is slipped past the meatus (Fig. 4884). Keeping the penis under reasonable tension aids in preventing the cutting of any part

of the urethra except the stricture. The knife is carried steadily downward by pushing upon its distal end, its cutting surfaces pointing in the median line, forward and upward, and backward and upward. The final contact of the knife with the anterior face of the stricture will be recognized by a sense of resistance – at which point a somewhat sharp thrust is given the knife staff, but controlled – until its blade is felt to cut its way, from before backward, through the structure (a sectional view of this stage is seen in Fig. 4885) – and to rest, at least temporarily, in ungrasped tissue. After a moment's pause a deeper stricture if present may be cut by the same maneuver – provided

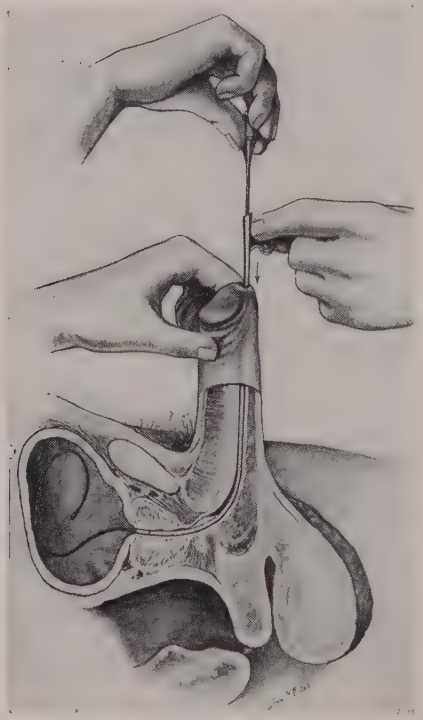


Fig. 4885.—The Same – II; – Sectional View of Internal Urethrotomy. (Modified from Albarran.)

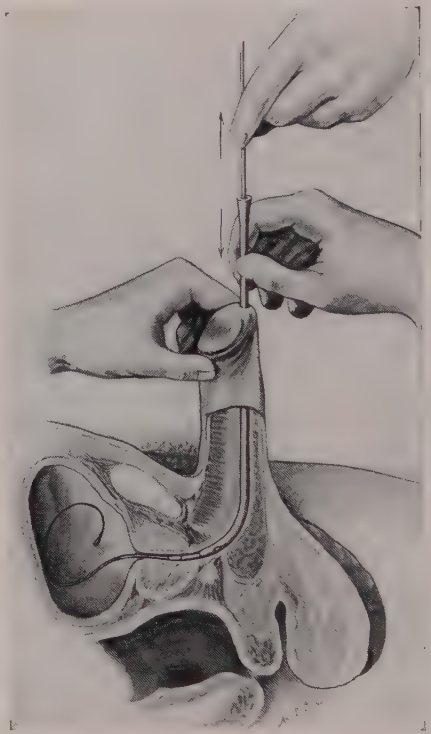


Fig. 4886.—The Same – III; – Following the withdrawal of the cutting blade, while the mandarin remains *in situ*, a rubber catheter is introduced into the bladder, over the mandarin as a guide. The mandarin is then drawn outward (with the arrow), as the catheter is pushed homeward (with the arrow.)

it be situated within the portion of the urethra to which internal urethrotomy is generally applied.

Upon the division of the stricture, or strictures the knife blade is carefully withdrawn, without changing its position, so that in the reverse direction it again passes through the stricture, now from behind forward – dividing, in its outward transit whatever constricting tissue may not have been cut in its inward passage. Unless the knife blade be sent through the stricture with some little impetus the tissue of a dense, fibrous stricture may be simply temporarily pushed out of the way, with but limited and unsatisfactory degree of cutting. Finally withdraw the cutting blade entirely.

At this stage two courses may be pursued: _ The staff, with attached whip guide may be withdrawn _ the urethra irrigated through a small catheter _ and a sound of normal size be passed, thus ending the technic; _ Or, after withdrawing the knife-blade, a rubber catheter, with lateral and terminal openings, may be threaded onto the combination metallic staff and attached whip guide, and be pushed on into the bladder _ after which the staff and guide are withdrawn _ and the catheter left temporarily anchored in the bladder and urethra (Fig. 4886). The temporary anchorge of a catheter after passing sounds is the better policy.

If, following the first withdrawal of the knife blade, difficulty be experienced in passing sounds up to the requisite size, the urethrotome is re-introduced, and the stricture additionally cut.

The catheter is usually withdrawn in from twenty-four to forty-eight hours _ the bladder irrigated _ and the patient left to himself.

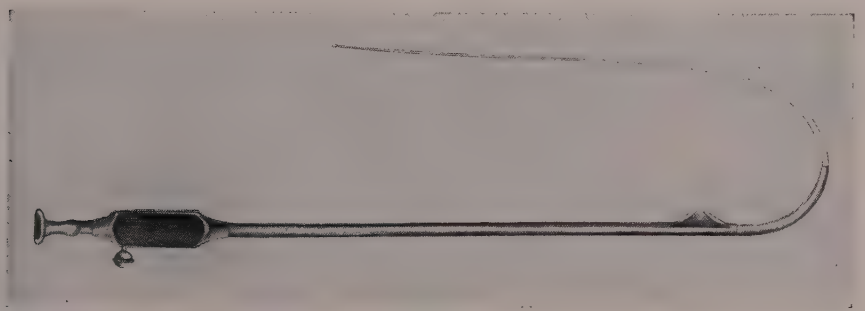


Fig. 4887.—Jeanbrau's Urethrotome. A similar instrument, with the blade upon the convexity, exists.

Comments.—A number of types of urethrotomes, acting upon the principle of the above technic, are in use. Jeanbrau's urethrotome is seen in Fig. 4887.

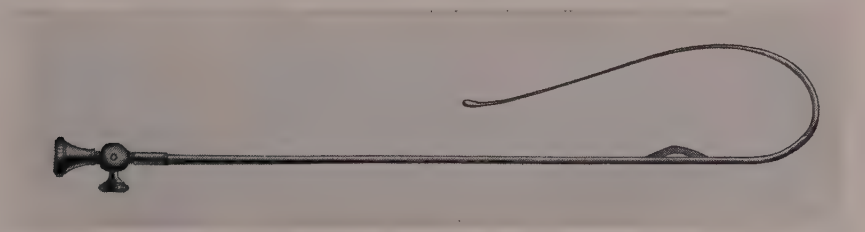


Fig. 4888.—LeFort's Electrolytic Bougie with Filiform Guide.

This instrument is also so made as to cut upon its convexity as well. An electrolytically equipped bougie, with filiform guide, is shown in Fig. 4888.

INTERNAL URETHROTOMY FROM BEHIND FORWARD—FOR STRICTURE OF THE URETHRA

BY OTIS-WYETH'S DILATING URETHROTOME

Description.—Division of a strictured urethra from within the urethra by means of a special instrument, a dilating urethrotome, introduced into the canal. If simultaneous dilatation be not indicated a plain urethrotome may be used. Internal urethrotomy is generally confined to the penile portion of the organ, and the incision is usually made from behind forward upon

the roof of the urethra. The Otis-Wyeth dilating urethrotome is seen in Fig. 4889.

Preparation.—Locate the exact position of the stricture by a bulbous bougie in the following manner: _ Introduce the largest sized bulbous bougie

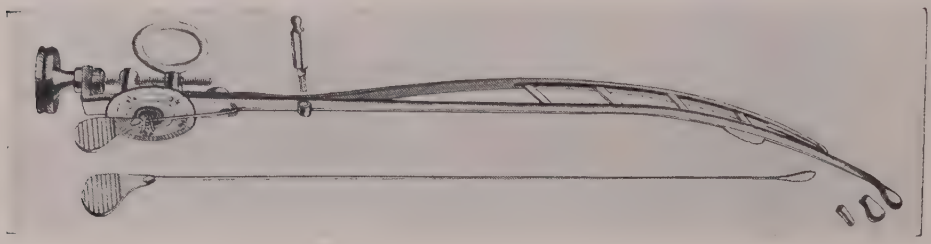


Fig. 4889.—Otis-Wyeth's Dilating Urethrotome.

which will pass the stricture _ draw it back until its shoulder is felt against the posterior end of the stricture _ bend the free portion of the bougie at the external meatus _ draw the instrument outward until the bulb slips through

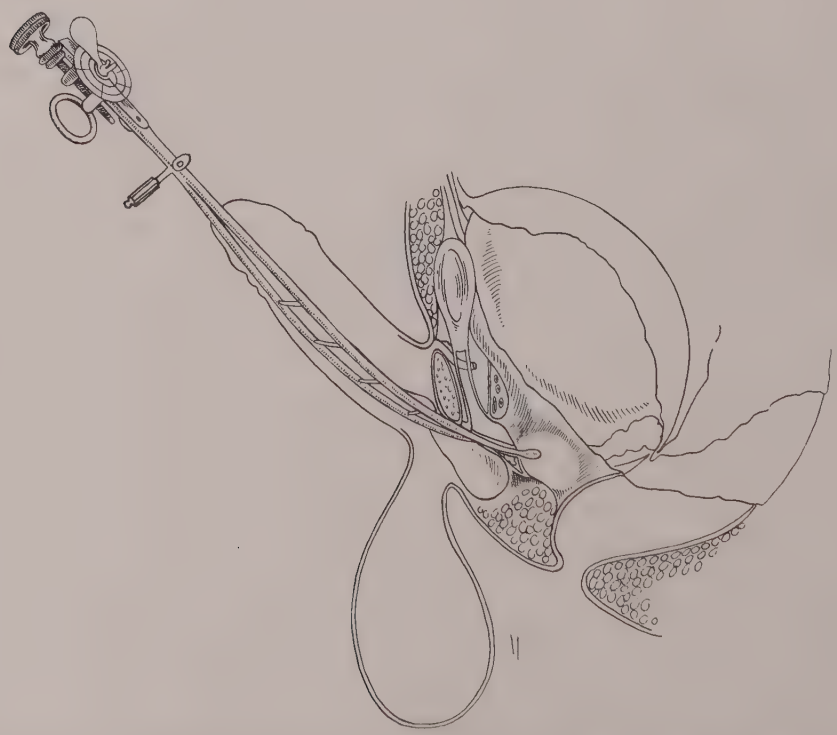


Fig. 4890.—Internal Urethrotomy; _ A dilating urethrotome is shown within the urethra _ the limbs of the instrument being moderately dilated _ and the knife-blade sprung so as to incise roof of spongy urethra anterior to the pubic arch.

the stricture _ then push it back until the tip of the bulb rests against the anterior end of the stricture _ then again bend the free portion of the bougie at the external meatus _ and withdraw the instrument entirely _ when the

portion of the handle between the two bends will represent the extent and distance of the stricture from the meatus. A more accurate means of getting the desired position and extent of the stricture is accomplished by the urethrometer. The urethra should be irrigated with a mildly antiseptic solution before instrumentalization — and a cocain or other analgesic solution thrown into the canal.

Position.—Patient supine at edge of table. Surgeon upon left, facing patient's penis.

Landmarks.—Previous data gotten from urethrometer or bulbous bougie. Known anatomy of urethra.

Operation.—The dilating urethrotome, with closed blades and concealed cutting edge, and well lubricated with aseptic lubricant, is introduced into the urethra after the fashion of a sound, until the concealed cutting edge has passed directly opposite the posterior aspect of the stricture, as determined by the previous measurement of the urethrometer corresponding with the measurement and distances marked on the urethrotome. The dilating blades are then put upon the stretch until the strictured urethra is rather tautly drawn — then the cutting edge, turned toward the roof of the urethra, is sprung by the controlling screw in the handle — and drawn through the stricture, to its anterior limit, from behind forward (Fig. 4890). It is then caused to sink below the blades — and the dilating blades again separated. If the cut-



Fig. 4891.—Gouley's Dilating Urethrotome with Adjustable Tips.

ting has allowed of sufficient dilatation, it is not repeated — if not, while the urethra is under dilatation, the blade is sprung a second time, and again caused to sink — after which the dilating blades are again separated, to see if sufficient dilatation has been secured, as indicated by the dial upon the handle. If so, the blades are permanently closed and the instrument is withdrawn. If there should be marked bleeding, a large sound, dipped in sterile cold water, is passed into the urethra and the penis bound to it.

Comments.—The Otis-Wyeth instrument will not enter a stricture smaller in caliber than No. 14 French scale — unless it be first dilated up to that size.

If the meatus be too small, meatotomy is first performed.

The position of all strictures should be known in advance of the operation.

The penis should be steadied during the manipulation.

Special care is necessary in closing and withdrawing the urethrotome, for it is apt to catch the mucosa in the closing angle of its blades and tear out a piece. If the blades seem to have caught the tissues, they should be pushed backward a little and opened slightly.

Following the final withdrawal of the instrument full size sounds are passed for verification of the caliber secured by the cutting.

The urethra is finally irrigated — and, if bleeding be a feature, or suspected, a full size catheter is carried into the bladder and anchored.

A urethrotome, acting upon practically the same principle, but with laterally expanding blades, is seen in Fig. 4891.

COMBINED INTERNAL URETHROTOMY AND DIVULSION IN STRICTURE OF THE URETHRA

The operation last considered – Internal Urethrotomy, from Behind Forward, by Otis-Wyeth's Dilating Urethrotome – constitutes one form of treating urethral stricture by combined internal urethrotomy and divulsion. Another form would be the limited cutting of a stricture by a simple type of urethrotome, followed by forcible distention with a large size sound.

EXTERNAL PERINEAL URETHROTOMY UPON A GROOVED STAFF PASSED THROUGH THE STRICTURE

SYME'S OPERATION

Description.—A grooved staff can be passed entirely through the stricture – and, upon this, the stricture is divided by incision through the perineum. The urethra is opened immediately in front of the stricture, upon the grooved staff, and then the stricture is divided. For the different grades of external urethrotomy see External Urethrotomy in General, p. 649.



Fig. 4892.—Syme's Grooved Staff for Urethrotomy.

Special Instruments Required.—Syme's grooved, shouldered staff (Fig. 4892) – or an ordinary lithotomy staff of small size, grooved medially upon its convex aspect, will answer. The shaft of the Syme staff is equivalent to No. 12 English scale, and its curved portion to No. 4. Gorget or special grooved director (Fig. 4893) for entering the incised urethra from the perineal wound.



Fig. 4893.—Teale's Probe-pointed Gorget.

The larger the grooved staff that will traverse the stricture, the better, or the larger the groove itself, of whatever staff will traverse it, the better, as it makes it easier to hit off the groove with the point of the knife. An ordinary medially grooved staff is seen in Fig. 4894.

Preparation.—Rectum empty, irrigated, and packed. Perineum shaved.

The bladder and urethra are sometimes irrigated with weak antiseptic solution. If necessary the urethra is dilated up to the size of No. 4 English.

Position.—The patient is at the end of the table, in the lithotomy position, with the buttocks elevated.

Landmarks.—Median perineal line; position of grooved staff in urethra, and especially the position of the stricture to be divided, as ascertained by previous use of the urethrometer, and also verified by the shouldered portion of the staff corresponding with the urethrometer measurements and resting against the anterior end of the stricture.

Incision.—Having introduced Syme's grooved staff (or a small centrally grooved lithotomy staff), well lubricated, into the urethra and through the stricture – so that its shouldered projection rests against the anterior aspect of the stricture, an incision is made in the median line of the perineum, so placed that the shoulder of the staff (that is, the anterior end of the stricture) will be exposed in the depth of the incision.

Operation.—Prior to the actual beginning of the operation – either by gradual dilatation some days in advance, or by rapid dilatation immediately before the incision of the urethra – the stricture, if it does not already do so, is brought up to take a No. 4 English sound. When this can be done in advance by gradually increasing sounds so much the better.



Fig. 4894.—Little's Grooved Male Lithotomy Staff.

Following the preparation of the perineum, emptying of the bowel, and under anesthesia, Syme's staff is passed down the urethra, until its shoulder is arrested by the anterior face of the stricture. Of course if the strictured urethra will take even a larger medially grooved sound, there is no particular object in using Syme's special type of instrument. The patient is brought into the lithotomy position, over the end of the table, with the buttocks elevated. An Assistant, at the patient's left, steadies the staff vertically, in the exact median line, and also displaces the scrotum upward.

The steps of the operation, as to the perineal structures incised and the manner of dividing them, are, practically, the same as in performing median perineal cystotomy (v. p. 550). The anatomy of the parts and position of the instruments are diagrammatically shown in Fig. 4896. The perineum is rounded out by the staff, which can be readily felt by the index-finger of the left hand through the tissues of an average person. A sharp-pointed, straight bistoury is used – and the aim is made to cut directly into the groove of the staff in the single stab incision, entering the groove just behind the shoulder of the staff – although it is better to sacrifice brilliancy to safety if one feels uncertain of being able to do this. The stab incision is made through the median line of the perineum, directly over the bulge of the staff, and about 4 cm. ($1\frac{9}{16}$ inches) in front of the anus (that is, enters at a point in the perineum a little

above a midpoint between anus and scrotum) – striking the groove of the staff at a point where it is beginning to curve away from the perineum and



Fig. 4895.—External Perineal Urethrotomy; – Steadying the bulb with the thumb and finger after incising the bulbous urethra.

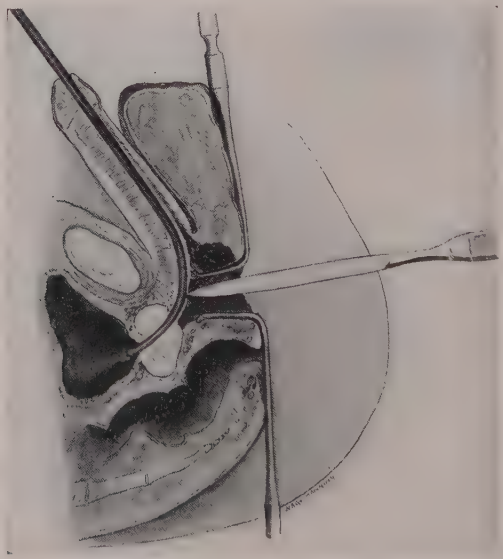


Fig. 4896.—External Perineal Urethrotomy in Section; – Incising the membranous urethra upon a grooved staff. The upper perineal retractor is drawing the bulb of the corpus spongiosum upward. The retraction of the perineal wound proper is usually lateral.

course upward through the membranous urethra, and through the prostate, to the bladder (Fig. 4895). If it be that the knife point does not enter the staff groove at the first thrust, the nail of the left index-finger, carried through

the perineal wound, readily recognizes the groove in the instrument, and directs the knife in the final opening of the urethra. The knife, incising the urethra just above the stricture, is carried through the stricture, and into the beginning of the membranous portion of the urethra. The urethra is usually incised for the distance of 1 or 2 cm. (6/16 or 9/16 inch). In withdrawing the knife the urethra and perineal wound should be enlarged amply for manipulation _ the requisite enlargement of the perineal wound and the entry of the membranous urethra are of practical importance. A sectional view of the technic is seen in Fig. 4896.

The probe point of the gorget is carried into the groove of the staff _ and thence, guided by the groove, into the bladder _ after which the grooved staff is withdrawn. One of two forms of bladder drainage is employed in concluding the operation:

A soft-rubber catheter is usually passed through the urethra from the meatus _ its end being guided through the perineal wound by the Surgeon's finger

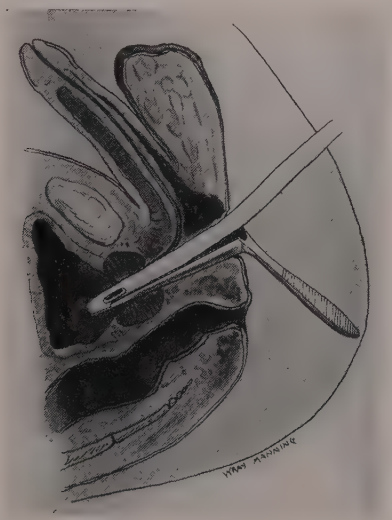


Fig. 4897.—External Perineal Urethrotomy; _ Establishment of bladder drainage by the passage of a catheter into the bladder through the urethrotomy wound upon a grooved director or gorget.

and on into the bladder, upon the groove of the gorget, on the proximal side of the perineal gap. Through this the bladder and urethra are irrigated to wash away all clots _ and the catheter is anchored for three or four days, when it may be changed or entirely omitted. The perineal wound heals by granulation, closing around the cicatrizing floor of the urethra _ the lumen of which is kept open and up to the requisite size by the periodic passage of a full size sound.

Or, instead of the above form of drainage, through the entire length of the urethra, a special form of short perineal drain (Fig. 4897) may be carried through the vesical end of the urethra, into the bladder, with its outer end projecting through the perineal wound, and held in the perineal dressing. If this form of drain be used, it is also carried into the bladder (into which it projects but a short way, just within the vesical sphincter) along the groove of the gorget (Fig. 4897).

In either form of drainage the excess of perineal wound may be closed from the two ends _ leaving its center open, to be slowly closed by granulation.

Before anchoring any form of drainage, and as soon as the stricture is first divided, a No. 30 F. sound should be passed into the bladder _ and if it cannot be passed, the meatus should be cut _ and if it be blocked by a stricture elsewhere in the penoscrotal urethra, this should be cut by internal urethrotomy.

Whether drainage be by the entire length of the urethra, or through the perineum, when either tube is withdrawn at the end of the first period of three or four days, a full size sound should be passed, and this is probably best followed by a full length urethral catheter of soft rubber, allowed to remain in a second period _ to be followed, in turn, by the passage of the large sound _ and the catheter may be again immediately replaced _ and this method of procedure repeated as long as may seem indicated _ or until the bladder and urethra become intolerant of the technic.

Comments.—The finger is sometimes carried into the bladder instead of the gorget _ the index-finger recognizing the groove of the staff as it is being withdrawn _ and as its end is felt the finger recognizes the roof of

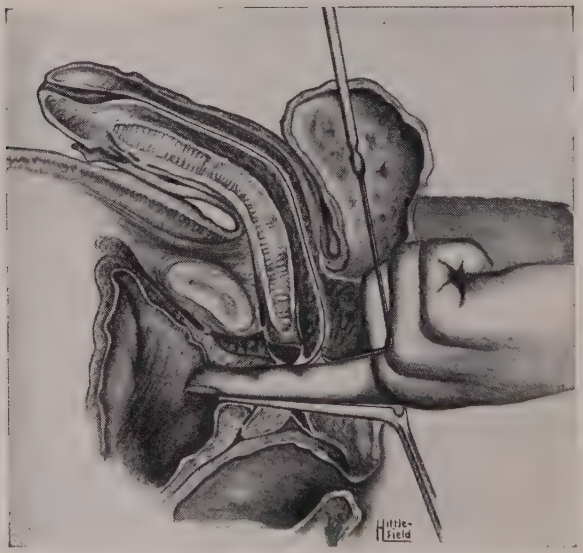


Fig. 4898.—External Perineal Urethrotomy in Section; _ Introducing the finger into the bladder, upon a grooved perineal director, following incision of the urethra.

the urethra _ and follows this on into the bladder, where a digital examination of the vesical meatus may be made. Sometimes the finger is guided into the bladder by the gorget (Fig. 4898).

It is well, whether full urethral or perineal drain be employed, that the ends of these should be connected with a rubber tube which passes beneath the bed.

Much difficulty as well as embarrassment may follow missing the staff in the initial incision _ but neither will be as great if the staff be missed simply by the incision not having gone deep enough _ as if it had passed beyond even the full depth of the urethra, but to one side.

Nothing is gained by packing gauze around the tube in the perineal wound itself unless for hemorrhage _ the dressing should simply be over the wound.

Some Surgeons do not introduce any solid sound into the bladder until about the twelfth day _ and continue subsequently to pass them at intervals of five to seven days.

The bladder may require occasional irrigation with silver solutions.
The perineal wound generally requires from two to six weeks to heal.

EXTERNAL PERINEAL URETHROTOMY UPON A FILIFORM GUIDE PASSED THROUGH THE STRICTURE

GOULEY'S OPERATION

Description.—In cases in which the grooved staff cannot be passed, and only a filiform whalebone guide can be made to enter the bladder _ a grooved tunneled guide is carried over the filiform down to the stricture (but not



Fig. 4899.—Gouley's Tunneled Sound and Filiform Guide.

throught it) _ and, upon this tunneled guide, the upper end of the stricture is exposed _ and the filiform is then followed on down into the bladder and the stricture divided. See External Urethrotomy, in General, p. 649.

Special Instruments.—Filiform whalebone guides; Gouley's (or other) grooved tunneled staff (Fig. 4899), and special grooved director (Fig. 4900).

Preparation _ Position.—As for Syme's operation, just described, except irrigation through the impervious urethra.



Fig. 4900.—Little's Grooved Lithotomy Staff.

Landmarks.—Median raphé; scrotoperineal junction; anus.

Incision.—In median line, from base of scrotum to a point about 1.3 cm. ($\frac{1}{2}$ inch) anterior to the anus.

Operation.—Having succeeded in getting a filiform whalebone guide into the bladder, Gouley's tunneled grooved staff is threaded upon this and carried down into the urethra upon it, with the right hand, while the left hand holds the filiform _ until it is arrested at or within the strictured urethra.

An Assistant now takes the filiform and metallic staff in his right hand and draws up the scrotum with his left. The Surgeon incises directly in the median line of the perineum, beginning at the scrotoperineal junction, and ending about 1.3 cm. ($\frac{1}{2}$ inch) in front of the anus. The incision at first passes only through skin and fascia. The lower end of the instrument in the urethra is then felt for, the Surgeon's left index nail depressing the intervening structures over the groove – and all the intervening tissues are now divided down to and into the groove – in the same manner and order as in the preceding



Fig. 4901.—External Perineal Urethrotomy Upon Gouley's Tunneled Sound and Filiform; – The perineum and deep urethra have been incised medially – and the lips of the urethral wound are here being held apart by thread tractors for the purpose of demonstration. The filiform has been passed into the bladder, and, upon it, the sound conducted down to the stricture.

operation (p. 668). A silk traction loop is placed in either lip of the urethral wound and the lips are then drawn apart – thus clearly demonstrating the interior of the urethral canal, from its normal lumen above to where it disappears below into an almost imperceptible lumen (Fig. 4901). The metallic staff is now partly withdrawn and steadied by an Assistant, using care to retain *in situ* the filiform by holding it in the perineal wound as the staff is withdrawn over it. Nothing now remains at the immediate site of the operation but the whalebone guide passing into the bladder. With a probe-pointed bistoury the filiform is carefully followed backward and the stric-

ture thus divided throughout its length and slightly beyond, upon its floor. The tunneled staff is then thrust into the bladder over the whalebone guide. The filiform is then withdrawn. A grooved director or gorget is passed into the bladder, through the perineal wound, over the grooved staff _ and the staff withdrawn. The remaining steps are the same as in Syme's operation (v. p. 669).

EXTERNAL PERINEAL URETHROTOMY UPON A GROOVED STAFF PASSED DOWN TO THE STRICTURE

WHEELHOUSE'S OPERATION

Description.—In these cases the grooved staff cannot be passed through the stricture _ nor can a filiform be passed through _ but a grooved staff can be passed down to the stricture _ and, upon this, the urethra is opened just in front of the stricture, and a fine grooved director is passed through it _ and the stricture is divided upon this last director. The urethra is thus opened in the median line about 6 mm ($\frac{1}{4}$ inch) in front of the stricture _ the feature of the operation being that at least this much of the sound urethra should be exposed in front of the stricture.

Preparation.—Perineum shaved. Lubricated Wheelhouse grooved sound (Fig. 4902) introduced down to the stricture and steadily held in the median line.

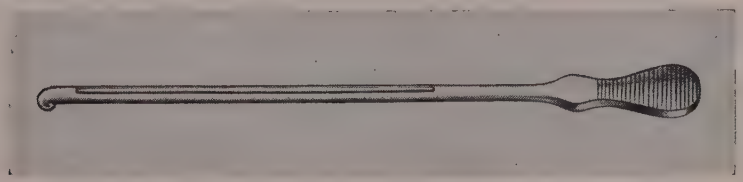


Fig. 4902.—Wheelhouse's Grooved Angular Perineal Staff.

Position.—Patient supine, in the lithotomy position at the end of the table. Surgeon seated opposite the perineum. Assistant on patient's left, holding staff.

Landmarks.—Median line; perineoscrotal junction; anus.

Incision.—From reflection of superficial perineal fascia at perineoscrotal junction _ to anterior border of sphincter ani.

Operation.—Incision is made in the median line to the above extent, and the tissues of the perineum are divided as in Syme's operation (p. 669) _ separating the tissues in the direction of the sound until the urethra is reached. The urethra is then divided to a limited extent upon the grooved sound _ especial care being taken that the urethra is opened about 6 mm. ($\frac{1}{4}$ inch) in front of the stricture _ the opening not extending down to the stricture. Looped silk traction ligatures are then put in through the lips of the divided urethra upon either side, and the two lips of the urethra are thus drawn apart. The grooved sound is then withdrawn a short distance _ just far enough to free its end from the remaining 6 mm. ($\frac{1}{4}$ inch) of intact urethra in which it had been, up until then, engaged _ the sound is then turned through a half-revolution upon its axis, so that its extremity now points outward _ and thus hooks up upon its concavity the upper limit (angle) of the urethral wound (Fig. 4903). The urethral opening is thus stretched apart in a lozenge-shaped manner, by the hooked sound above, by the traction ligatures on each side, and by the attachement of the intact urethra below.

While thus held apart and well exposed a fine probe-pointed grooved director, or gorget, is insinuated into and along the strictured urethra with its groove uppermost. Even often when the opening cannot be seen the director will often find its way toward the bladder among a mass of distorted tissue. The groove of the director is now turned downward _ and the strictured portion of the urethra is divided upon its floor by a knife passed along the director.

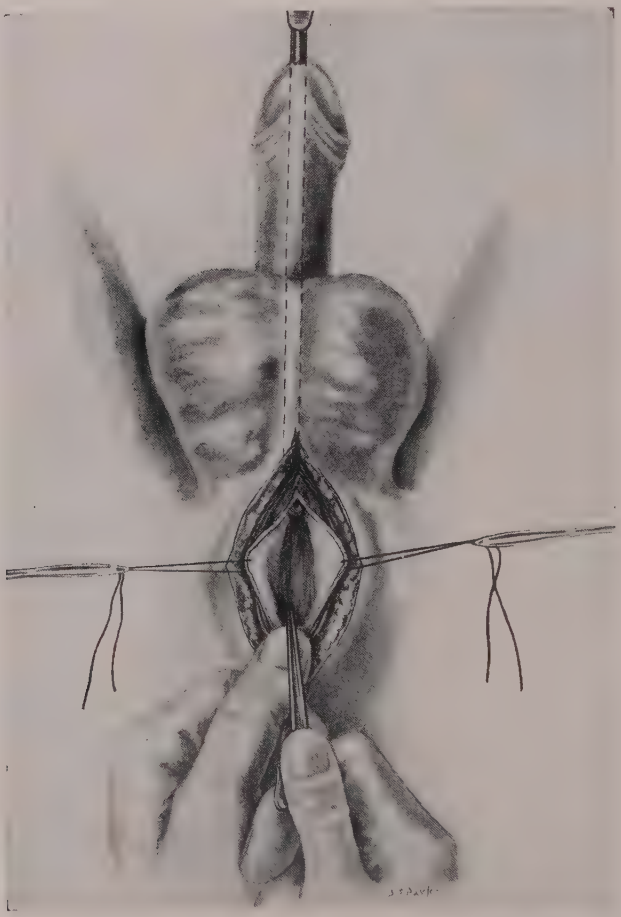


Fig. 4903.—External Perineal Urethrotomy Upon a Grooved Staff Passed Down to the Stricture _ Wheelhouse's operation; _ Wheelhouse's special grooved staff is passed, and held in the usual position until the incision into the urethra has been made _ after which its tip is turned forward, and its curve is used to hook forward the distal end of the incised urethra. Thread tractors or special clamp forceps retract the sides of the split urethra _ while the proximal end of the cut urethra is being depressed to make plainer the lumen of the tube _ which a probe-pointed, grooved director is in the act of entering. An ordinary sound may be used instead of Wheelhouse's.

The knife is withdrawn and the groove of the director, still in the urethra, is turned upward _ and a metallic sound is then passed from the meatus and is guided through the opened urethra by the fingers in the perineal wound _ and thence on to the groove of the director _ and thus into the bladder. A soft catheter is allowed to remain *in situ* for three or four days during granulation of the parts around the new canal _ and is then passed daily until the

perineal wound heals. The perineal wound may be partly closed by suture, but is left unsutured in part, at least, for drainage.

Comment.—If the staff hooked into the incised urethra be in the way, it can be dispensed with.

If no sufficiently patulous proximal end of the urethra be found to admit a grooved director, sometimes a probe may first find its way _ and this be followed by a grooved director.

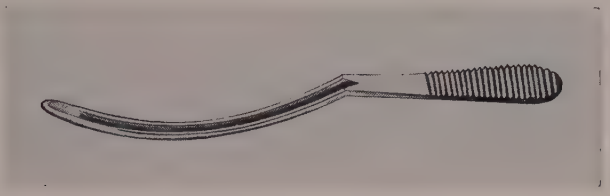


Fig. 4904.—Key's Director.

While the regular Wheelhouse staff is, technically, the instrument intended to be used, any form of curved, grooved staff will usually suffice. The upper part of the wound may generally be satisfactorily retracted with a wound hook.

Instead of thread tractors the lips of the incised urethra may be lightly clamped.



Fig. 4905.—External Perineal Urethrotomy; _ Incising the urethra upon a grooved staff, **a**, introduced through the penis into the bladder; **b, b,** tractors of the perineal wound. In this case the staff usually temporarily employed is, when the perineum is incised, able to be carried into the bladder.

Owing to the fact that the urethra has not been divided actually into the site of stricture _ an essential part of the technic _ it is possible to utilize the little urethral pocket just distal to the stricture as a funnel _ by rolling out the sides of which one is guided down to the distal opening of the actual constriction.

The wound should be gotten very dry of bleeding by gauze pressure in seeking for obscure urethral channels. Adrenalin solution may be used.

If direct search for the proximal urethral lumen be unavailing, collateral searching in all possible positions should be made. If pressure upon the bladder will force out a little urine, this will be a useful guide.

One is to be wary of possible diverticula, constituting false passages.

The steps following the division of the stricture and entry into the bladder are essentially the same as in Syme's operation (v. p. 668). Bladder drainage is provided either by a catheter from the meatus, anchored in for three or four days, or by a bladder drain conducted out of the perineal wound _ the ends of which are usually sutured, and whose center is left open. The subsequent passage of sounds is as in Syme's operation.

Sometimes nothing larger than a grooved canaliculus probe can be inserted into the proximal lumen of the urethra. At other times one may be able to get in a fairly large grooved director of special curve _ such as shown in Fig. 4904.

While the grooved staff (provided one of the usual curve be used rather than the Wheelhouse model) may not have been able to do more than reach the anterior face of the stricture when originally passed, it sometimes happens that after the urethra has been incised and the distal opening of the proximal portion of the urethra has been demonstrated, the original staff, which may have been turned in its axis and used as a hook (v. Fig. 4903), is again turned so as to conform with the urethral curve _ and may be, occasionally, passed on into the bladder. In such an event as this the floor of the tightened urethra is incised upon the groove of the original staff _ as shown in Fig. 4905.

EXTERNAL PERINEAL URETHROTOMY WITHOUT A GUIDE

COCK'S OPERATION

Description.—In these cases neither a grooved staff nor even a filiform bougie can be passed through the stricture. The urethra is practically impassable to all instruments (from the presence of several strictures, false passages, rupture, disease, and the like). No attempt is made to use any form or guide. The urethra is opened posteriorly to the stricture and immediately anterior to the prostate. The bladder is thus relieved _ and the anterior portion of the urethra is treated subsequently

Preparation.—Perineum shaved. Bladder partly full.

Position.—Lithotomy position at edge of table. Surgeon seated facing perineum. Assistant holds penis and testes out of the way.

Landmarks.—Median line; perineoscrotal junction; anus.

Incision.—In median line, from perineoscrotal junction, to within about 1.3 cm. ($\frac{1}{2}$ inch) of the anus.

Operation.—The Surgeon introduces the left index-finger into the rectum, with nail to the sacrum, and keeps the tip of his finger against the apex of the prostate gland. Cock's double-edged, straight knife, entering horizontally, is then made to cut directly and boldly in the median line of the perineum, toward the tip of the left index-finger entering 1.2 cm. ($\frac{1}{2}$ inch) in front of anus _ the entire cut being made with one sweep of the knife, which cuts forward and backward in its withdrawal. Or the incision, beginning above near the perineoscrotal junction, passing inward to the prostatic urethra, and ending below about 1.3 cm. ($\frac{1}{2}$ inch) anterior to the anus, may be more deliberately made, though not Cock's technic. The incision of tissues is, practically, the same as that for median perineal cystotomy. The deepest part of this triangular incision will be at the apex of the prostate gland, and the most superficial

at the upper and lower ends of the base of the triangle upon the perineum. The knife is at no time withdrawn until the full depth of the wound and apex of the prostate gland are reached, as its reinsertion would be uncertain. In the depth of the wound the knife point is guided by the tip of the left index-finger (Fig. 4906) _ and the urethra, at the posterior part of the membranous portion, is divided in its median aspect, or slightly obliquely _ the anterior part of the prostate often also being divided.

Having incised the urethra, the knife is withdrawn _ but the left index is kept in the rectum in contact with the apex of the prostate. While the edges of the deep perineal wound are well retracted a probe-pointed director is inserted into the opened urethra, guided by a finger in the rectum _ and pushed on into the bladder. Perineal drainage is established by passing a soft catheter through the wound in the perineum into the bladder _ the catheter being held in place by the perineal bandage or a T-dressing band.



Fig. 4906.—External Perineal Urethrotomy Without a Guide; _ The left index-finger is introduced through the rectum to the apex of the prostate gland both to guide knife and to protect the rectum _ while a double-edged knife is carried directly through the perineum into the urethra.

This operation is generally resorted to where the urethra is very extensively involved or destroyed. If, therefore, the perineal opening is not to be a permanent one steps may be taken subsequently, after restoration of the structures in whole or in part, with reference to the opening up of the anterior portion of the urethra by dilatation, or urethrotomy, or other measure.

Comment.—While the original operation by Cock was done in this manner, and generally abandoned if the urethra was not reached in two or three attempts, there is no reason why (and this is now generally done) the tissues should not be divided more deliberately and the urethra more persistently sought for. One should be guided by an intimate knowledge of the anatomy of the parts in the face of great difficulties _ for often the structures are unrecognizably altered.

As this procedure was employed to chiefly relieve acute vesical distention, no immediate step was made to repair the strictured portion of the urethra, at the time of the original operation, after opening up the urethra immediately posterior to the stricture. If the circumstances of the case admit, however.

of correcting the condition of stricture, at the time of relieving the bladder retention, without jeopardizing the patient, this should, of course, be done — and the method of accomplishing this will depend upon the local conditions in the individual case.

All in all, the method of more deliberate dissection of the perineum and exposure of the urethra is more surgical than the "stab in the dark" — as is, practically, the procedure above described. Some such measures, often demanded in the most desperate class of cases, will be described in the immediately following pages.

OTHER URETHROTOMY MEASURES FOR RELIEF OF SEVERELY STRICTURED URETHRA

The distinctive feature of all perineal operations for the relief of strictured urethra — especially of that grade of stricture greater than encountered



Fig. 4907.—External Perineal Urethrotomy; — Incising a stricture above the level of the perineal incision — by carrying the knife a short way toward the meatus, nearly parallel with the staff.



Fig. 4908.—Combined External and Internal Urethrotomy; — The stricture of the deep urethra is incised by external perineal urethrotomy — and a grooved director, or gorget, carried into the bladder. The penile stricture is cut by a dilating urethrotome passed from the meatus down to the perineal grooved director.

in average cases — is deliberate and detailed dissection of the involved parts — so that the structures exposed may be identified — and that the technical measures for the relief of the stricture, as well, if possible, as the permanent repair of the pathologic urethra, may be carried on satisfactorily, and with safety to the adjacent structures. Such a technic is in marked comparison with that described as the original Cock perineal section (v. p. 678).

No hard-and-fast rules can be laid down — but conditions must be met as they present themselves — and oftentimes several combinations of technic will be called into use in the same case — the perineal tract of the urethra may be alone involved in the surgical procedure — or the perineal and penoscrotal conjointly — or the perineal urethra (membranous and prostatic),

together with the bladder – or the penile, perineal, vesical, and suprapubic tracts may be all involved simultaneously in the measures required for the relief of the condition.

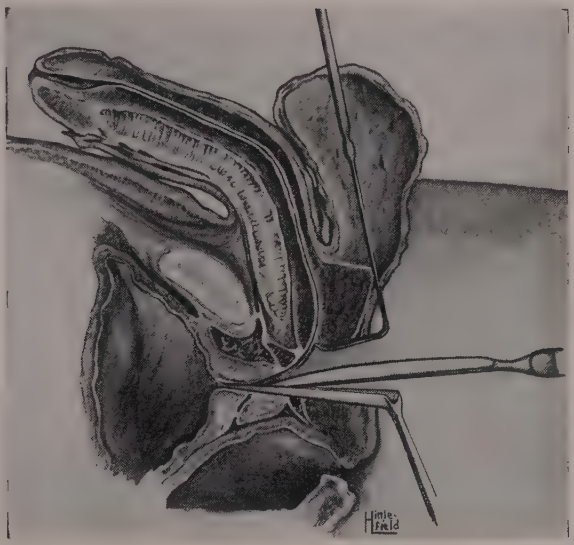


Fig. 4909.—Enlarging the Membranous and Prostatic Urethra by Incising Upon a Gorget or Grooved Director.

In operating upon a major stricture of the deep urethra an adjacent nearby constricture, between the main one and the penis, through which the



Fig. 4910.—External Perineal Urethrotomy; – Upward traction upon the bulb to better expose the membranous urethra.

groove staff has passed, may be discovered. Such a condition may be met in one of two different ways. Either a long, straight bistoury may be carried

along the groove of the staff, made to cut its way through the stricture, by paralleling the knife with the groove of the staff – as shown in Fig. 4907, or the penoscrotal stricture may be cut by passing a urethrotome from the meatus downward, thereby performing internal urethrotomy of the more distal stricture, conjointly with external urethrotomy of the more proximal stricture. In Fig. 4908 a dilating urethrotome is seen passing down through



Fig. 4911.—External Perineal Urethrotomy by Retrograde Instrumentation; – Incision of the bulbous urethra, **a, a,** for impermeable stricture – followed by incision of the membranous urethra – with retrograde passage of grooved director, **b,** from the membranous through the strictured bulbous urethra. The tip of the director is seen in the anterior wound.

the urethra from the meatus – coming into contact with a gorget, which has been passed through the perineal wound into the bladder.

It will sometimes be necessary to incise the distal portion of the prostatic urethra after incising the membranous urethra – involving the section of the apex of the prostatic gland. The accomplishment of this upon a gorget or grooved director is seen in Fig. 4909.

In working at these greater depths the satisfaction of recognizing the

individual structures is great – and, when these are not too confusedly distorted by pathologic processes, which, unfortunately, is often the case, an attempt should always be made to do so. A technical procedure helpful to this end is, after retracting the margins of the wound laterally, to retract the bulb upward by a third retractor (Fig. 4910) – thus directly exposing the membranous urethra.

Retrograde Instrumentation Through the Membranous Urethra.—A median perineal incision of the usual type may have been made with the expectation that through it the surgical procedure may be entirely conducted. But on laying open the bulbous urethra it may be impossible to locate the proximal end of the urethra. In such an instance one may proceed to expose the membranous urethra through a prolongation of the same incision – or,



Fig. 4912.—Illustrating Position of Instruments in External Perineal Urethrotomy by Combined Suprapubic and Penile Routes; – Locating the position and extent of impermeable stricture by combined urethral and vesical sounds, preparatorily to incising the stricture between the ends of the instruments. The perineal wound should be first made.

in addition, may add to it a curved perineal incision, placed about 2 cm. ($\frac{3}{4}$ inch) in front of the anus. Through such a T-shaped incision the parts may be freely exposed. When the membranous urethra is brought well into the wound its normal portion is medially incised back of the stricture – and through the incised membranous urethra a grooved probe may usually be carried forward, and made to emerge through the hidden lumen in the already incised bulbous urethra (Fig. 4911). Upon the grooved probe thus passed through the stricture a probe-pointed or sharp-pointed knife may be passed and the stricture cut. The perineal wound is treated in the same general way already described.

Combined Retrograde Instrumentation Through a Suprapubic Cystotomy Incision and Through the Penile Urethra.—The general use of

the instruments in this technic is shown in Fig. 4912 in sectional view _ but the picture is not illustrative of the operation itself, as no perineal wound

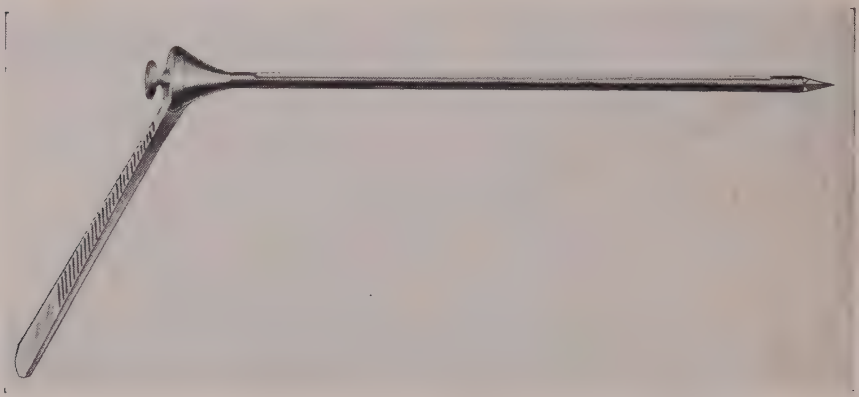


Fig. 4913.—Guiteras' Grooved Urethrovesical Trocar and Cannula.

has been made. The procedure is as follows: _ Upon finding the operation otherwise impossible a suprapubic cystotomy is performed upon the distended bladder. Through the entrance into the bladder thus made, a sound with

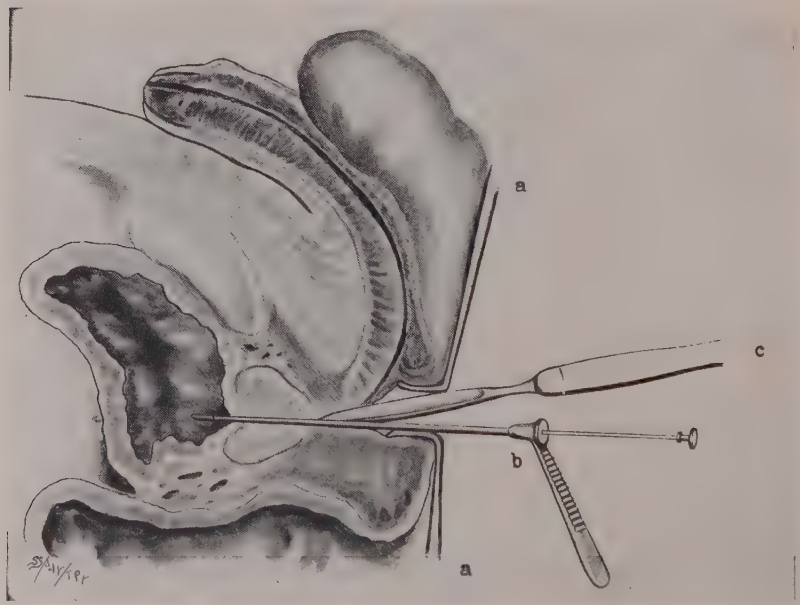


Fig. 4914.—External Perineal Urethrotomy for Close Stricture Aided by Guiteras' Perineal Grooved Cannula: _ a, a, Retractors of the perineal wound (the upper one also serving to hold the scrotum out of the wound); _ b, Guiteras' grooved cannula, passed through the prostatic urethra; _ c, knife carried along the grooved guide, through the stricture, and into the bladder (from which the urine has run upon withdrawal of the stilet).

marked curve is passed through the vesical meatus and along the prostatic and membranous urethra as far as it will go. With the patient in the lithotomy position, and the sound rounding out the perineum, the sound is cut down

upon by median perineal incision. If a grooved director can be passed forward from the proximal end of the stricture thus exposed, through the stricture, toward the penis, the stricture is cut through upon this grooved director _ which is, after the preceding steps of the operation, easy. But if the grooved director cannot be passed forward from the poststrictural part of the urethra laid open upon the transvesical sound, a second sound is passed from the meatus of the penis to the anterior face of the stricture _ and the floor of the stricture is then cut through between the ends of the two sounds _ after which a full size catheter is passed from the meatus, through the stricture, into the bladder, and anchored. The suprapubic bladder wound is sutured and the overlying soft parts are sutured down to a temporary drain which passes to, but not into, the bladder.

External Perineal Urethrotomy by Guiteras' Grooved Ureterovesical Trocar and Cannula.—The perineal incision is made upon a grooved urethral

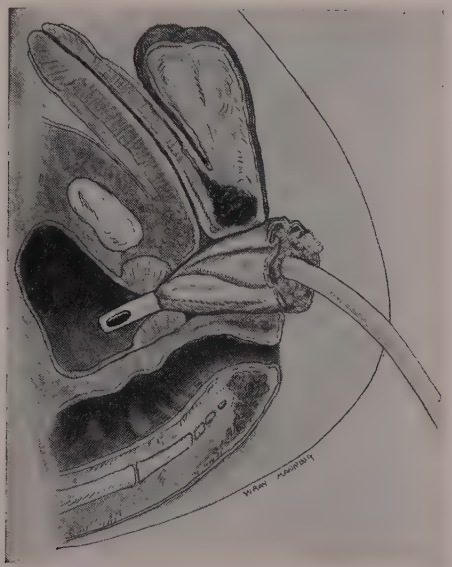


Fig. 4915.—Catheter en Chemise; _ The catheter in the bladder and the bag in the perineal wound, distended by inner gauze packings.

sound carried down to the anterior face of the stricture _ upon which the urethra is opened in front of the stricture. Guiteras' special grooved urethrovesical trocar and cannula (Fig. 4913) are then carried into the bladder along the course of the urethra intervening between the perineal wound and the neck of the bladder. The entry of the instruments into the bladder is demonstrated by the flow of urine upon the withdrawal of the trocar _ after which a narrow, sharp knife is carried along the groove of the director, and the strictured urethra laid open to the desired extent (Fig. 4914).

It sometimes happens in the more extensive perineal operations that severe bleeding occurs. In order to simultaneously make provision for bladder drainage and gauze pressure in the deep perineal wound the catheter may be slipped through a hole in the middle of a piece of gauze _ and after the catheter is in position this umbrella-like arrangement of the gauze may be packed full of strips of gauze to secure the necessary pressure _ as suggested in Fig. 4915

URETHROPLASTY FOR STRICTURE OF THE URETHRA

The principle of the Heineke-Mikulicz pyloroplastic procedure (v. Vol. IV, p. 284) is here employed _ and in appropriate cases may prove a simple solution of an otherwise complex problem.

After mobilizing the urethra sufficiently for manipulation an axial incision is made through the entire thickness of the outer aspect of the urethral wall _ the incision extending into sound tissue, immediately above and below the stricture (unless the length of the stricture be considerable). Manipulating with forceps, to steady the urethral lips, and a curved needle, held in a holder, non-penetrating sutures are carried, in an axial manner, through the lips of the same axial half of the urethra (Fig. 4916) _ in such a manner so that



Fig. 4916.—Urethroplasty for Constricted Urethra; _ The axially incised urethra is being sutured transversely.

when these are tied they will tend to considerably widen the lumen of the urethra.

A temporary drain is carried down to the site of sutured urethral wall to provide for possible urinary leakage _ and is conducted outward between the sutures of the overlying soft parts.

OPERATION FOR URETHRAL STRICTURE BY PARTIAL URETHRECTOMY

Description.—In this method of procedure some limited portion of the urethra is excised, and the continuity of the canal re-established by suture. If it be possible to excise the site of stricture without making a complete transverse division of the urethra, or without excising a complete transverse segment of the canal, it is desirable to do so. If, on the other hand, a complete transverse segment of the urethra must be excised, one of two conditions may result: _ Either that the portion removed is so limited that the opposite send of the urethra may be brought directly together by suture _ or, owing

to the larger removal, or the greater immobility of the parts, that some form of plastic procedure must be resorted to in order that the gap may be bridged.

The circumstances under which partial urethrectomy is usually performed occur in those cases of urethral stricture not favorable to, or do not yield to, other forms of treatment. They are generally of the perineal urethra — and frequently result from traumatism.

The principle of technic usually employed in partial urethrectomy for stricture of the urethra consists in the following features: — The exposure of the strictured portion of the urethra and of the normal urethra immediately in front of and behind the strictured site — after which one of four courses is generally pursued — either the strictured portion of the urethra is excised, leaving the roof of the urethra intact, followed by the suturing of the urethra — or the complete transverse excision of a limited portion of urethra may be followd by the end-to-end suturing of the proximal and distal portions, — or the gap between the divided ends, in excisions of longer segments, may be allowed to re-form around a retained catheter — or some special type of plastic operation may be performed.

Partial Excision of the Floor and Sides of the Urethra for Stricture, With Retention of the Roof of the Canal.—The site of stricture is exposed by a straight, median incision of sufficient length for free manipulation. Less frequently a curved incision is employed, with upward or downward convexity, with the downward or upward displacement of the resulting flap. By careful dissection of the overlying structures — the operation usually falling within the perineum — the urethra is exposed, and is sufficiently isolated, by blunt and sharp dissection, and over a sufficient length of its course, for the necessary manipulations. While one side of the urethral wall is steadied by toothed forceps in the Surgeon's left hand, and the opposite urethral wall, by forceps in the Assistant's hand, a median incision is made entirely through the floor of the urethra. As soon as the floor of the stricture has been axially incised and sufficiently opened for investigation, effort is made to determine the proximal and distal limits of the stricture — by the passage of special probes, or sounds, through the incised urethra. Sometimes the anterior limit of the strictured urethra is determined by the combined introduction of a sound through the meatus, carried down to the anterior face of the stricture, together with recognition of its site of arrest by a finger within the perineal wound. The axial incision, in the floor of the urethra, finally should be carried into sound urethra just beyond the anterior and posterior limits of the stricture. Up to this stage the features of exposure are, practically, the same — no matter what technic be subsequently adopted.

In the method here under consideration it is convenient, after splitting open the strictured urethra, to place four traction sutures, two on each side, just beyond the limits of the stricture, through the margins of the incised urethral wall — as seen in Fig. 4917. By means of these tractors the involved urethra may be readily rolled out to view. A rubber sound may be conducted from the meatus, into the bladder, at this stage — or its introduction may be deferred until the partial excision has been performed. Its use is to serve as a form over which to do the suturing in the subsequent steps. While tensing the parts by the tractors and steadying the strictured part of one side between the two tractors of that side by forceps, the thickened floor and lateral wall of that side of the urethra is excised by scissors. In the majority of instances it is the floor of the urethra and part of the lateral walls which are chiefly involved. The floor and opposite sides of the urethra are similarly excised. When the areas have been excised and the parts are under moderate tension, the angularities are rounded out — or, better, the original excisions

might be better made with curved scissors, thereby avoiding the tendency to angularizing any part of the wound. The partially excised urethra is now as seen in Fig. 4918. One may elect to repair the wounded urethra by non-penetrating sutures – but usually in these complex problems of suturing through-and-through chromic catgut sutures are employed – introduced in the manner shown in the illustrations last quoted. The lateral incuts of the

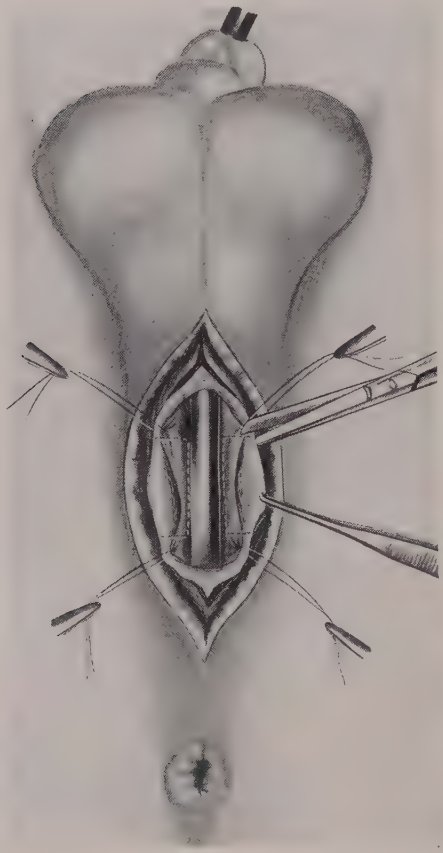


Fig. 4917.—Partial Excision of the Deep Urethra for Stricture – I; – The deep urethra has been opened by perineal incision made over a sound passed, if possible, through the urethra. Thread tractors have brought the medially divided urethra well into the wound. The hyperptrophied, constricting part of the inferior wall of the urethra is being excised along the dotted lines. (Figs. 4917 and 4918 modified from Legueu.)



Fig. 4918.—The Same – II; – The margins of the laterally excised areas are brought together by axially placed, through-and-through sutures, knotted on the outer side. The median urethral incision is closed by through-and-through transversely running sutures.

urethral wall are first oblitered by suturing their margins together by longitudinally running stitches – after which the margins of the axial incision are brought together by transversely running stitches.

If there be any question as to the unsafe narrowing of the urethra in the process of suturing, provision against this should be made in some such manner as shown in Fig. 4919, where, following a partial excision in which the original

long axial incision has not been extended beyond the actual limits of the site excised, two limited axial incisions are made in the floor of the urethra. In the subsequent act of suturing (Fig. 4920) the resulting slight elbowing of the part gives increased width of lumen, against the contraction which is due to follow. Finally, the surrounding cellular tissue and overlying muscular layers are brought together by suture (Fig. 4921) — invariably, however, making provision to carry a temporary drain down to the site of the sutured urethra in the event of urinary leakage or infection.



Fig. 4919.—Excision of a Segment of the Deep Urethra for Stricture, Followed by Urethroplasty — I; — The floor and most of the circumference of a segment of the urethra have been excised — and the roof left intact. The floor of the urethra has been axially incised in the median line — to increase the area for transverse suturing. Two of the non-penetrating sutures are seen passed (through the outer coats only). a, Accelerator urinæ (bulbocavernosus) — or compressor urethræ, if in the membranous portion; — b, spongy body.

Excision of a Transverse Segment of the Urethra for Stricture Followed by Suturing of the Ends.—Having exposed the strictured urethra by the preliminary steps mentioned in the preceding operation, the necessary minimum length of the urethra is excised. Two limited, axial slits are then made through the floor of the urethra at either end — to counteract the tendency to constriction always present in the simple, circular suturing of a tube of small caliber. The suturing is usually done with penetrating, chromic catgut stitches. The posterior stitches are first placed, bringing together the roof of the canal (Fig. 4922). These stitches are tied on the inside and cut short. The lateral stitches are next placed, and are tied on the outside and left long, as temporary tractors (Fig. 4923). The anterior sutures are finally placed

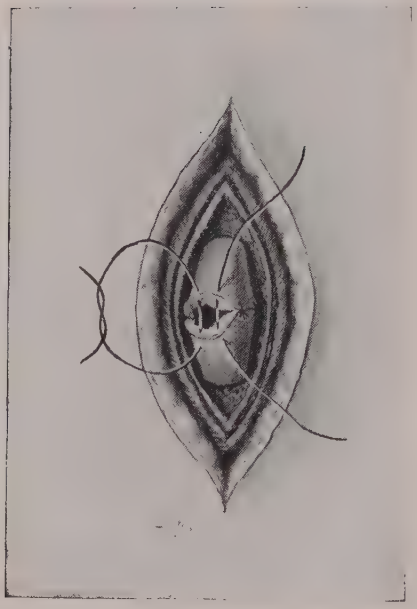


Fig. 4920.—The Same _ II; _ Non-penetrating sutures of the outer layers of the anterior aspect or floor of the urethra. Owing to the added axial incision a slight lateral increase of lumen follows the suturing.

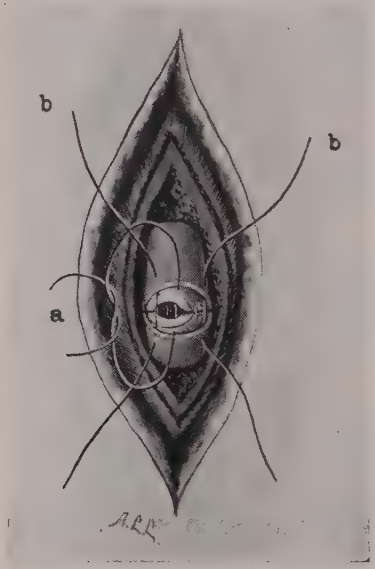


Fig. 4921.—The Same _ III: _ a, Sutures approximating the anterior aspect of the outer layers of the urethral ends; _ b, b, sutures uniting the anterior cellular tissue.



Fig. 4922.—Excision of a Transverse Segment of the Urethra for Stricture, Followed by Suturing of the Ends _ I; _ The segment has been excised, the ends of the urethra limitedly incised, and two of the posterior penetrating sutures placed, ready to be tied on the inside.

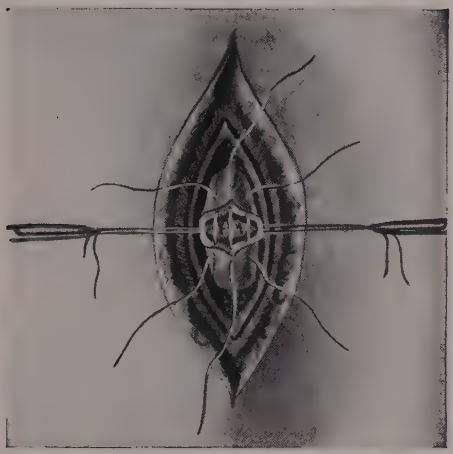


Fig. 4923.—**The Same** _ II; _ Two of the lateral, non-penetrating, tied-on-the-outside sutures are used as temporary tractors, while the anterior non-penetrating stitches are being placed.



Fig. 4924.—Perineal Excision of a Limited Complete Segment of the Deep Urethra for Stricture, Followed by Suture _ Doyen _ I: _ **a**, Accelator urinæ (bulbocavernosus) muscle; _ **b, b,** sutures through the posterior urethral cellular tissue, as relaxation sutures, to lessen the direct strain upon the sutured urethral ends. The posterior half-circumference of the urethral ends are united by their cellular layers to the same posterior cellular tissue, **c, c.**

and tied (v. Fig. 4923). The posterior sutures are, almost of necessity, penetrating, because of the difficulty of placing them. The lateral and anterior

stitches are, preferably, non-penetrating, as the parts, laterally and anteriorly are sufficiently accessible to make this possible. Drainage, as usual, is carried down to the sutured urethra before the soft parts are otherwise brought together.

Excision of a Transverse Segment of the Urethra for Stricture, Followed by a Special Method of Approximating and Suturing the Divided Ends (Doyen).—A metallic sound is introduced through the spongy urethra. A median perineal incision is then made, and the end of the sound located at the anterior end of the cord-like urethra extending between the normal spongy and membranous portions. This constricted, cord-like portion of the urethra is then transversely excised at its anterior and posterior limits.

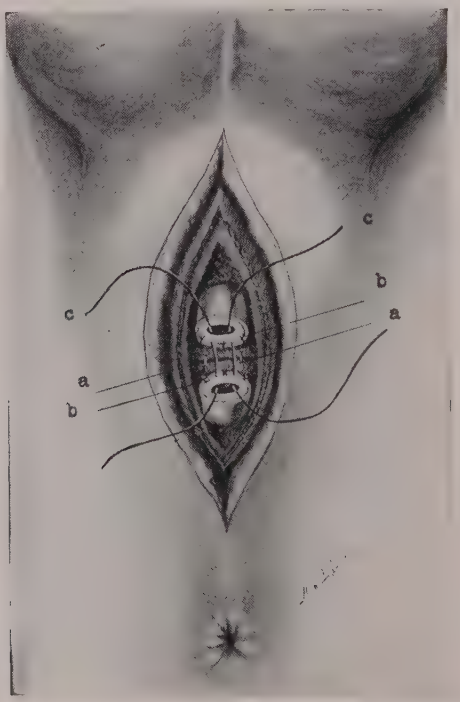


Fig. 4925.—The Same—II: —a, a, Connective tisue relaxation sutures; —b, b, sutures connecting the posterior cellular coat of the urethral ends to the posterior cellular bed are seen tied. Two sutures, c, c, are shown ready to approximate the posterior aspect of the muscular and mucous layers of the urethral ends.

The posterior half-circumferences of the urethral ends are next sutured to the retro-urethral cellular tissue by silk stitches which pass through only the outer coats of the urethral wall (Fig. 4924, **b, b**). The retro-urethral cellular tissue itself is then brought together by two buried lateral stitches of strong No. 3 silk—which when tied, helping to approximate the ends of the urethra, serve as relaxation sutures, lessening the strain upon the ends of the urethra when they are sutured together. When the urethral ends are brought nearer together by this tying of the connective-tissue stitches the urethral ends themselves are sutured together by through-and-through stitches of fine silk carried by fine curved needle so that the urethral punctures will not admit of urinary leakage through the stitch holes. The sutures

all penetrate the walls of the urethral ends – but are, otherwise, placed as in the last described operation – that is, the posterior ones are tied on the inside (Fig. 4925, **c, c**) – and the lateral and anterior on the outside. The sectional view of the sutured parts is seen in Fig. 4926. Temporary drainage is carried down to the site of the sutured urethra. The overlying soft parts are sutured together up to the exit of the drain.

Excision of a Transverse Segment of the Urethra for Stricture, Followed by the Restoration of the Canal by Triple Perineoscrotal, Urethroplastic Flaps.—This method of procedure consists in the establishment of a skin-lined urethra to fill in the interval between the two ends of the urethra left after the excision of the strictured site, in cases where the two divided ends are too far separated for any hope of direct union.

The perineal hair is preliminarily destroyed by repeated galvanopunctures or by the application of zinc paste. The site of stricture is exposed as in the preceding methods, and the involved portion of the urethra is excised. Two lateral flaps are first planned out of which to construct the urethral

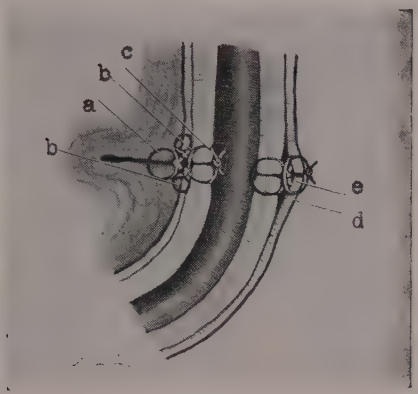


Fig. 4926.—The Same – III: – **a**, Suture of posturethral cellular tissues; – **b, b**, sutures of posterior aspect of cellular layer of urethral ends to posterior cellular tissue; – **c**, suture of posterior aspect of muscular and mucous coats; – **d**, suture of anterior aspect of muscular and mucous coats; – **e**, suture of anterior aspect of cellular coats.

canal. (*a*) The skin-flap which is to form the roof of the new canal (Fig. 4927, **e**) is first raised. It is rectangular in form and calculated to be of sufficient size to fill in the bed of the gap without tension. The skin and connective tissue of this flap are mobilized from the underlying parts by undercutting – after which the flap is glided toward the opposite side, across the wound – and its free lateral margin sutured to the opposite free margin of skin (Fig. 4928, **a, b**). The walls of the two cut ends of the urethra, corresponding with their roof, are sutured, by three chromic catgut stitches, to the centers of the upper and lower margins of this inwardly shifted flap (v. Fig. 4928). A retention catheter is carried from the urethra into the bladder and allowed to remain *in situ* for ten days – after which the pedicle of the now united flap is severed along the dotted line seen in the picture last quoted. (*b*) The skin-flap which is to form the floor of the new canal (v. Figs. 4927 and 4928, **d**) of skin and connective tissue is raised, at a subsequent séance, and turned inward, so that its raw surface remains outermost – and the free margin of this latter flap is sutured into the margin of the deeper perineal wound, from which the pedicle of the first flap was cut – so that it lies beneath the skin

level (Fig. 4929, f). The walls of the two cut ends of the urethra, corresponding in this case with the floor of the urethra, are sutured to the center of the upper and lower margins of this last inverted flap _ thus completing the floor of the new urethra. A retention catheter is kept in position, from meatus to bladder, through the new canal. (*c*) The outer, raw surface of the second lateral flap is now immediately covered, at the same séance, by a rectangular perineoscrotal flap (Fig. 4930) _ which is planned of shape and size to cover in all the raw surfaces of the preceding steps of the double-stage operation.

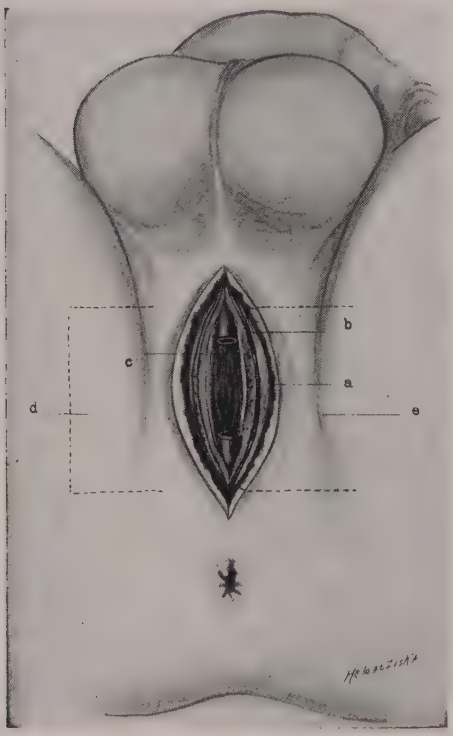


Fig. 4927.—Urethroplasty by Triple Perineoscrotal Flaps in Loss or Excision of Entire Segment of Deep Urethra _ I: _ a, Skin and fascia; _ b, accelerator urinæ (bulbocavernous); _ c, spongy body. Following partial excision of the urethra the resulting proximal and distal ends of the urethra are, in this case, found too distant for direct union by suture; _ d, lateral perineal flap to be raised externally and hinged internally; _ e, lateral perineal flap to be mobilized internally by undercutting.

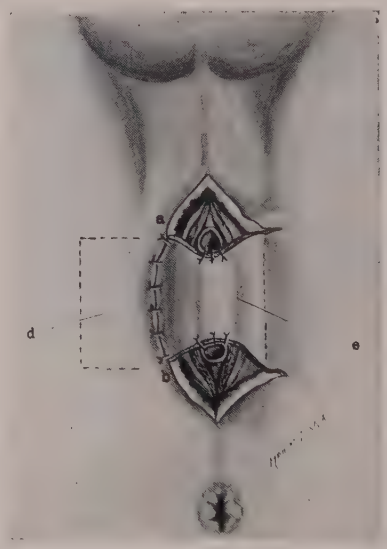


Fig. 4928.—The Same _ II; _ The flap, e, has been mobilized and drawn over and sutured to the opposite edge of the perineal wound, at a, b. The deepest margins of the upper and lower urethral wounds are shown sutured to the upper and lower borders of this flap, which thus forms the roof of the new urethra. A dotted line shows where the flap, e, will be divided. The area of the right flap, d, is dotted

This flap is mobilized by undercutting and displaced downward _ and its three sides sutured to the sides and base of the denuded region. If there be any outlying portion of the original median incision, it is closed by suture. If there be any question of technic, or possible infection, or urinary leakage, a temporary, superficial drain should be employed.

Comment.—Partial urethrectomy is not suitable in the presence of more than one stricture _ unless the secondry ones are insignificant and treatable by other means.

In performing partial urethrectomy previous preparation should be made of the suprapubic region as well _ both because of the possibility of requiring retrograde catheterization to locate the proximal end of the urethra, and because of subsequent postoperative suprapubic drainage, which may be preferred.

Fine chromic catgut and through-and-through sutures are usually employed.

Even after the excision of as much as 3.9 cm. ($1\frac{1}{2}$ inches) of urethra, if the remaining urethral ends be well mobilized, the cut ends of the urethra can usually be brought together by direct suture.

Suprapubic suction drainage for seven to ten days is much preferred by some Surgeons in preference to the retained catheter passed through the urethra _ which is apt to soon cause irritation, to become intolerable, and even to invite urinary leakage alongside of it, besides possibly interfering with the healing of the sutured urethra.

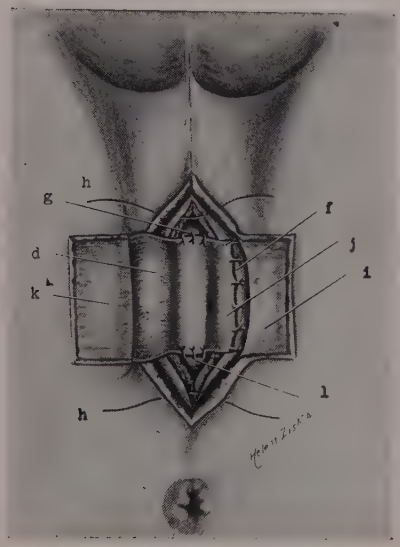


Fig. 4929.—The Same _ III; _ The left flap, e (Fig. 4928), of which i was the bed, has been severed and sutured into the wound at the margin, f. The right flap, d, of which k is the bed, has been inverted and sutured to the opposite margin of the perineal wound, beneath the flap e, at the line f (over the flap e), skin to skin _ and also sutured to the more superficial margins of the upper and lower urethral ends, g and l _ thus forming the floor of the new urethra. Sutures, h, h, draw the ends of the perineal wound somewhat more together.

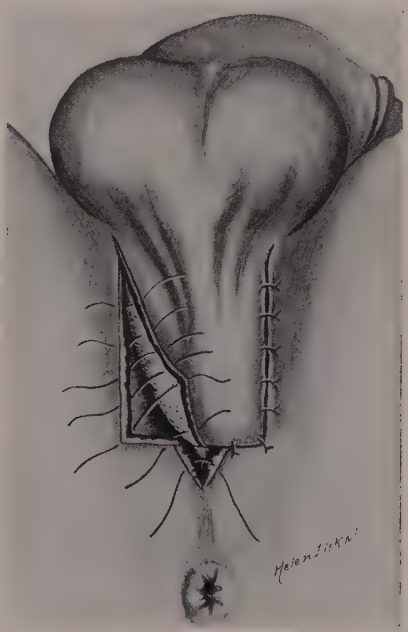


Fig. 4930.—The Same _ IV; _ A trilateral perineoscrotal flap, with pedicle above, is brought down and sutured into the square area resulting from the preceding steps. The lowermost angle of the wound may be separately sutured.

At the end of about four weeks a full size sound should be passed.

OPERATIONS FOR URETHRAL FISTULÆ, IN GENERAL

Urethral fistulæ, arranged according to the sites of their openings, may be classified into: urethropenile, urethroperineal, urethroperineoscrotal, urethrorectal, and urethroperineorectal. Irregular and unusual forms of urethral fistulæ may open upon even the buttocks, abdomen, thigh, or hip. Fistulæ

are usually single, but may be multiple – and may be so small a fine probe will scarcely follow them, or of considerable caliber, from loss of substance – as well as straight or tortuous – short or long.

The commonest causes of urethral fistulæ are: stricture, periurethral infection, urethral ulcers, rupture of the urethra, wounds, foreign bodies, impacted calculi, and the like.

Some of the commoner types of urethral fistulæ are shown in Fig. 4931.

The salient features of surgical treatment of urethral fistulæ, in genreal, are the following: – (*a*) Removal of cause, – (*b*) Restoration of the impaired urethra, – (*c*) Provision for bladder drainage during the repair of the defect, – (*d*) Control of infection, or active inflammation, before beginning any operation of repair.

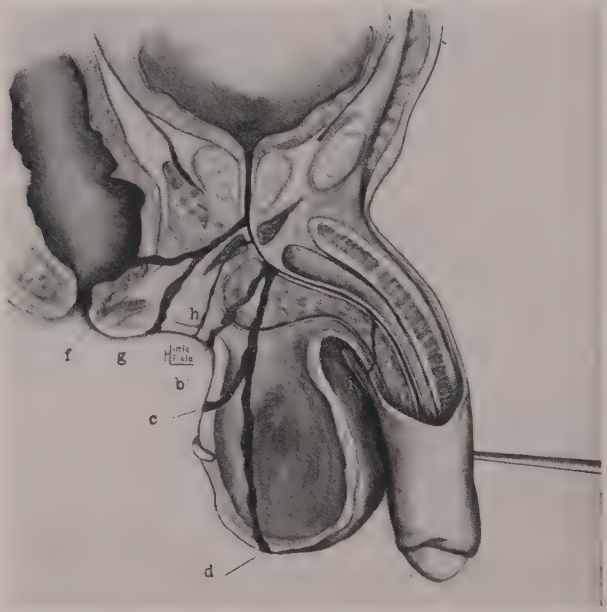


Fig. 4931.—Fistulæ of Urethral Origin Seen in Cross-section: – **b, c,** and **d,** Fistulous tracts from the bulbous urethra to the perineum and to the scrotum; – **f** and **g,** fistulous tracts from the membranous or prostatic urethra to the rectum and to the perineum; – **h,** through the area of the triangular ligament; – **i,** through the penile urethra.

Drainage of the bladder during the healing of the plastic operation for the restoration of the urethra is especially important. Some Surgeons adopt the retention catheter. Others hold that suprapubic suction drainage should be a preliminary to all plastic operations for the repair of urethral fistulæ.

Many ingenious technics have been devised for the restoration of the fistulous urethra, including autoplastic and heteroplastic procedures – some of the more important of which will be here mentioned.

The repair of fistulæ of the penile urethra will be first considered – and then those of the perineal urethra.

OPERATIONS FOR FISTULA OF THE PENILE URETHRA

Closure of Penile Fistula by Simple Denudation and Suture.—The margins of the fistula are carefully pared, so as to present raw borders for

direct union. This is best accomplished by passing a soft-rubber catheter into the urethra as a distending form upon which to work. The margins of the fistulous opening are then seized by delicate forceps, and are excised by a very sharp, thin-bladed knife or by delicate curved scissors. If buried sutures are to be used in any part of the technic, fine chromic catgut is employed – otherwise silk or catgut may be chosen. In Fig. 4932 suturing of the margins of the overlying skin and connective tissue is shown, the approximation of these borders being depended upon to draw sufficiently together the margins of the urethral opening. In Fig. 4933 a single layer of sutures is used, which pass into the structures of the urethral wall, but do not entirely penetrate these structures and enter the urethral lumen. In Fig. 4934 two tiers of

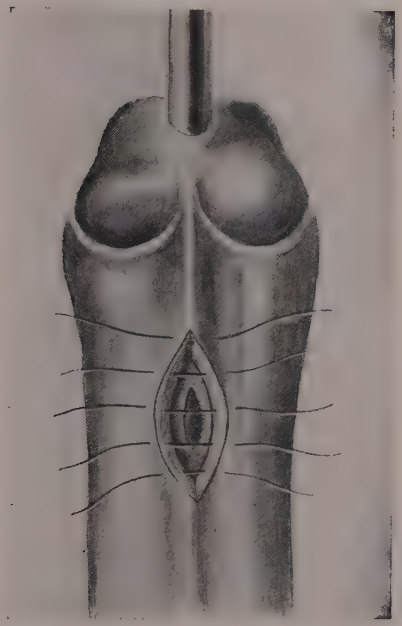


Fig. 4932.—Operation for Penile Fistula by Simple Superficial Suture; – Following excision of the fistulous opening, and the introduction of a urethral sound, interrupted sutures are carried through the skin and fascia only, down to but not into the urethral wall – after which the skin margins are approximated over the opening in the urethral wall, which is left to close spontaneously.



Fig. 4933.—Operation for Penile Fistula by Simple Deep Suture; – Following excision of the fistulous opening and introduction of a sound, interrupted sutures are carried through the skin and part of the wall of the urethra, but not into the lumen.

sutures are employed, the tier of buried sutures, of fine catgut, pierce only the outer walls of the urethral opening without entering its cavity – while the outer tier, of silk or catgut, take up the skin and connective tissue overlying the defect. Either the second or third technic is preferable and probably the third is to be chosen.

Closure of Penile Fistula by Denudation and Suture, Aided by Lateral Relaxing Incisions (Dieffenbach).—A soft-rubber catheter is passed into the urethra, after which the borders of the fistulous opening are freshened. Then in order to allow the margins of the defect to be approximated two parallel relaxing incisions are made to either side of the denuded margin (Fig. 4935). The axial bridge of skin, on either side, between the two parallel cuts,

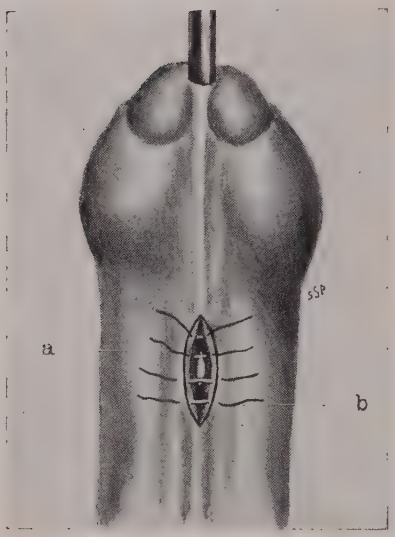


Fig. 4934.—Closure of Urethral Fistula by Buried and Superficial Sutures: – a, Type of buried sutures, including part of connective tissue and part of urethra, but not entering the urethral lumen; – b, type of superficial sutures, including the skin and part of the connective tissue.

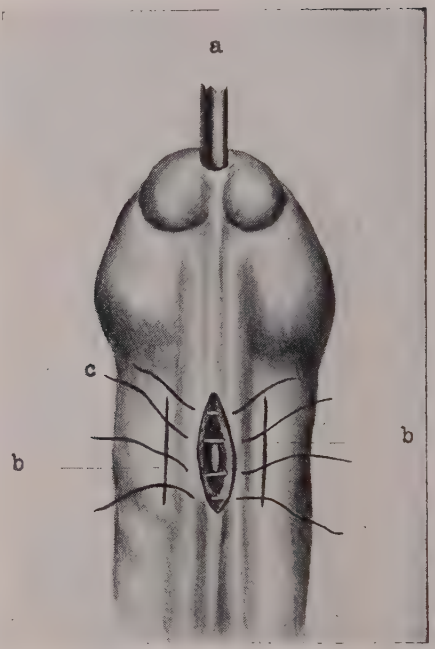


Fig. 4935.—Dieffenbach's Operation for Penile Fistula – I; – The fistulous tract has been excised upon a distending sound, a. Two relaxing axial incisions, b, b, are made on either side of the hypospadiac opening. The skin and fascia are mobilized and sutured over the urethra by sutures not entering the urethra, c.

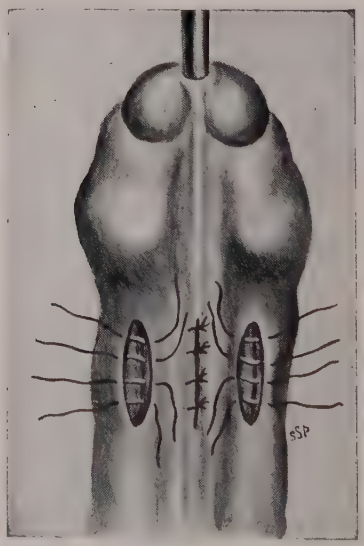
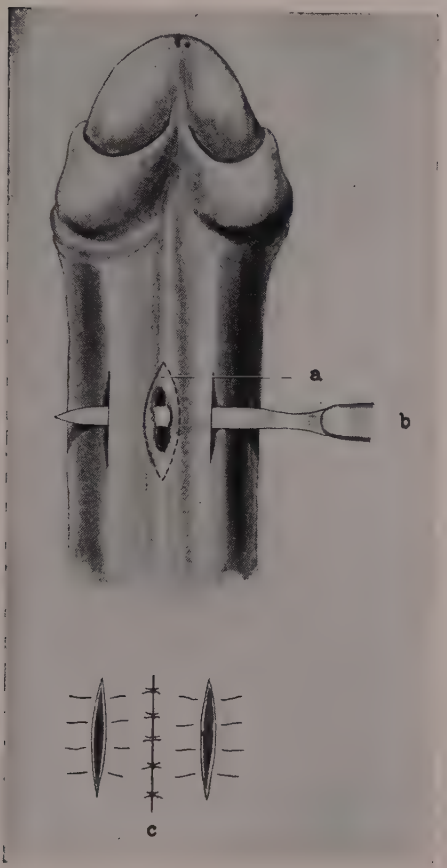


Fig. 4936.—The Same – II; – The skin and fascia over the fistulous opening has been closed and the margins of the relaxing incisions are also being sutured.

and the outer margins of the denudation, are mobilized by undercutting in the connective-tissue plane – which will enable the inner margins of the denuded area to be approximated and sutured (Fig. 4936) – after which the two lateral wounds are closed by suture – mobilizing the skin to the outer sides of these cuts if necessary. The sutures which unite the denuded borders of the fistula enter the margins, but do not penetrate the mucosa of the urethra.



Figs. 4937 and 4938.—Dieffenbach's Urethroplasty for Urinary Fistula of the Penile Urethra: – a, The fistulous area is excised – and the neighboring tissues are mobilized by lateral transfixion by knife, b. The median wound is then closed – the lateral cuts serving as relaxation wounds. c, Showing relation of the parts in suturing.

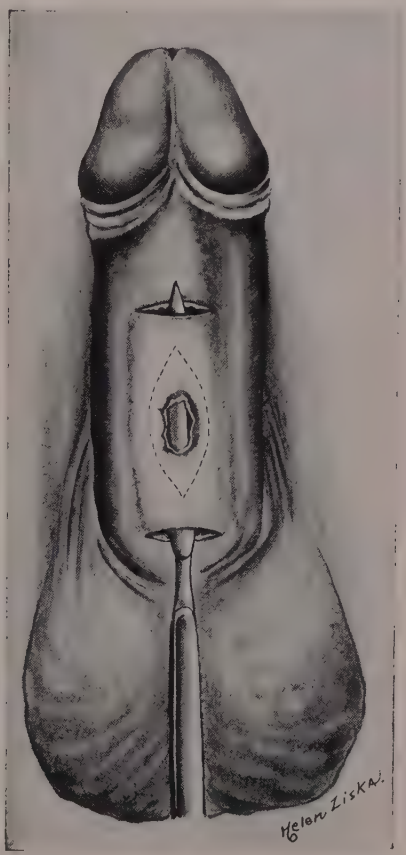


Fig. 4939.—Nélaton's Urethroplasty for Urethral Fistula; – The area of excision (here somewhat too large) of the fistulous tract is represented by a dotted ellipse. a, Knife (following excision of the fistula) in the act of entering below and emerging above the fistula, frees the overlying skin and fascia.

Note.—In either of the above, or in any of these operations for penile fistula, if it be felt that a fine buried, non-penetrating urethral suture can be advantageously placed before suturing together the margins of the skin this should be done.

Another method of accomplishing the mobilization of the two lateral skin-flaps, in Dieffenbach's technic, after making the elliptic excision of the fistulous outlet, is shown in Figs. 4937 and 4938.

Closure of Penile Fistula by Denudation and Suture, Aided by Transverse Relaxing Incisions.—The fistulous tract is excised by elliptic incision, the axis of which may be transverse or longitudinal, as better suited to the position and contour of the fistula. Two transverse incisions are made at some little distance above and below the fistula, through the skin, into the connective tissue _ and, between these, the blade of a straight narrow bistoury is passed (Fig. 4939) _ which cuts as far as indicated upon one side and is then withdrawn and similarly mobilizes the opposite side. When sufficient mobilization of these transverse bridges is accomplished the margins

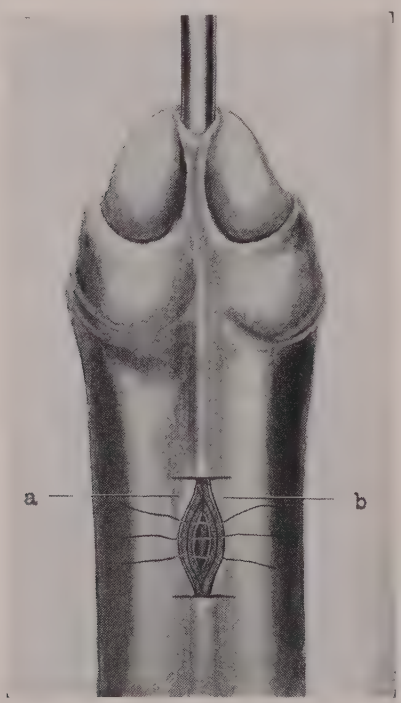


Fig. 4940.—Closure of Penile Urethral Fistula by Excision and Bilateral Flaps _ I; _ The fistula has been excised _ two lateral flaps, a and b, made by transverse incisions, above and below the fistula _ and non-penetrating, buried sutures applied.

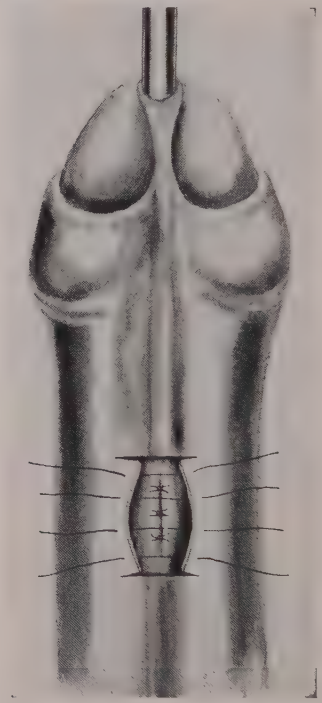


Fig. 4941.—The Same _ II; _ The skin-flaps are being sutured along the middle and transverse lines.

of the fistula and adjacent skin are closed by suture _ and then the two transverse incisions are sutured.

Closure of Penile Fistula by Gliding Two Lateral Flaps.—The margins of the fistula are elliptically excised, the axis of the ellipse corresponding with that of the penis. At the upper and lower limits of the ellipse, two parallel, transverse incisions are carried outward from the median line. The lateral flaps represented by these incisions (Fig. 4040, **a**, **b**) are mobilized by cutting in the connective-tissue plane. The margins of the pared fistula and the deeper boundaries of the opening are brought together by buried, non-penetrating catgut sutures _ after which the median borders of the flaps are sutured together (Fig. 4941). And then two or three stitches unite the upper and lower aspects of the barn-door flaps to the skin adjacent to the transverse cuts.

Closure of Penile Fistula by Single, Glided Lateral Flap (Nélaton).—The area of the fistula is denuded by a quadrilateral flap _ which is raised from the connective-tissue plane, while the excision includes the margins of the fistula (Fig. 4942, **a**). The covering flap is raised from one or the other side _ by continuing outward, to one side, the upper and lower limits of the rectangular area just excised (v. Fig. 4942, **b**). This lateral flap is mobilized well outward, so that when it is displaced mediad its median border will reach to the extreme lateral limit of the denudation, where it is sutured (Fig. 4943). Before, however, suturing the flap into position the margins of the fistula are closed by non-penetrating catgut sutures (which are not shown in the illustration).

Closure of Penile Fistula by Median Inverted and Lateral Glided Flaps (Guyon-Pasteau Method).—The fistula is excised by a quadrilateral

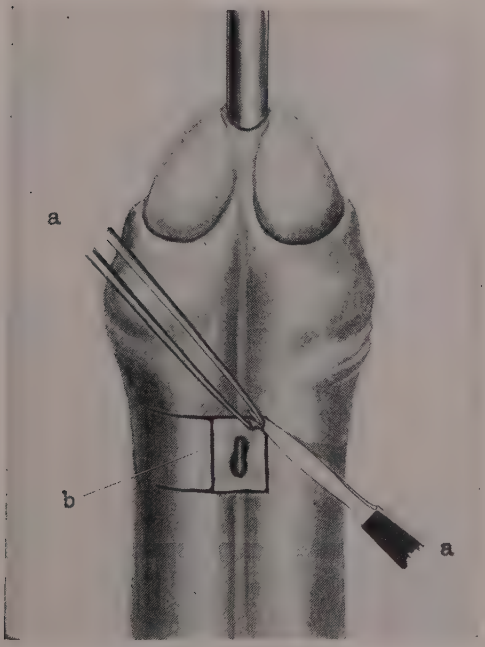


Fig. 4942.—Closure of Urethral Fistula by a Single Lateral Flap _ I: _ **a, a,** Denudation of area of fistula; _ **b,** flap to be mobilized.

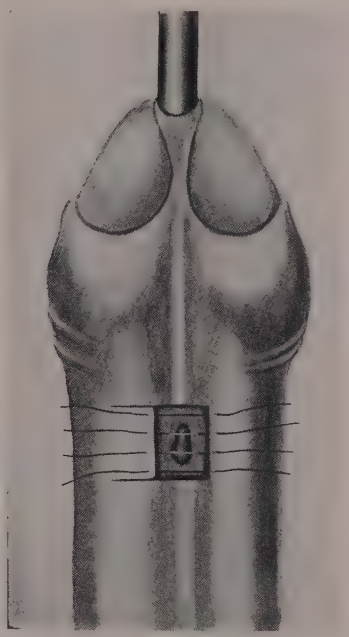


Fig. 4943.—The Same _ II; _ Suturing of mobilized and undercut flap over the fistula and the surrounding freshened area.

flap (Fig. 4944, **a**). A median, rectangular flap, hinging toward the glans penis, is raised from its connective-tissue bed (v. Fig. 4944, **c**). Two lateral rectangular, barn-door flaps are next raised (v. Fig. 4944, **b, b**) directly to either side of the excised rectangular flap whose center was the fistula. In excising the flap which includes the fistula this denudation is only made down to the connective-tissue plane. The manner of raising the three covering flaps is seen in Fig. 4945. The median flap is now inverted, turning its skin surface inward, and suturing its margin beneath the margin of skin immediately above its inverted end (Fig. 4946). The two lateral flaps are then glided mediad, and sutured together over the median, inverted flap, raw surface to raw surface (Fig. 4947). The bed left by raising the median flap which has been inverted is closed by transverse sutures. When the inverted flap has

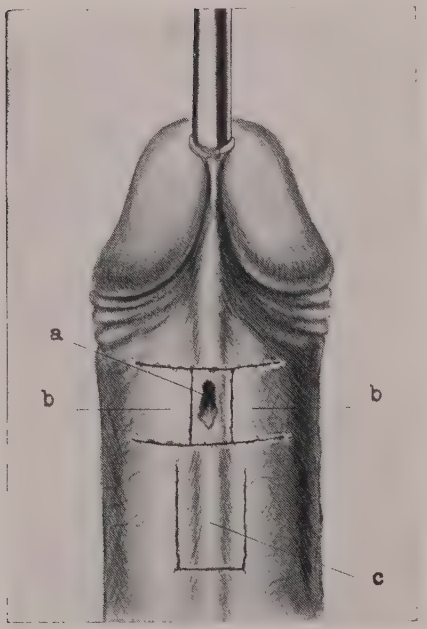


Fig. 4944.—Closure of Urethral Fistula by an Axial and Two Lateral Flaps _ I: _ a, The quadrilateral area, denuding the fistula; _ b, b, two lateral flaps; _ c, axial flap. The flaps are here only outlined by incisions

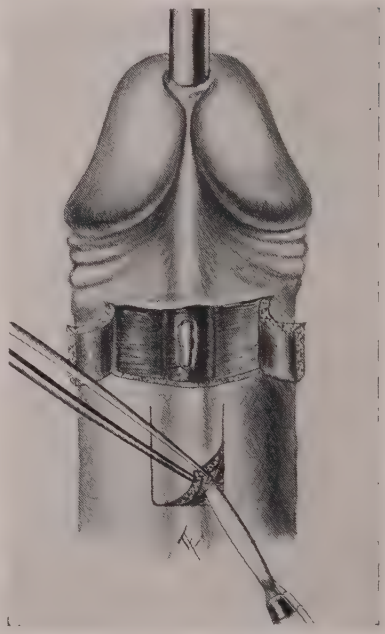


Fig. 4945.—The Same _ II; _ The two lateral flaps have been raised and turned outward. The axial flap is being dissected up.

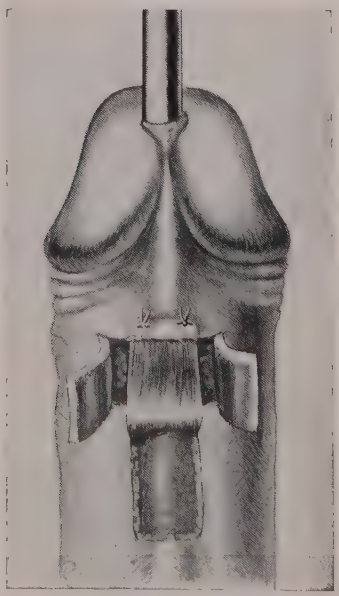


Fig. 4946.—The Same _ III; _ The axial flap has been inverted and sutured beneath the marking of the skin, just above the defect.

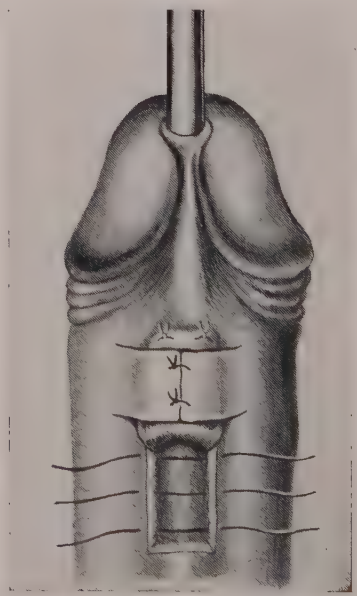


Fig. 4947.—The Same _ IV; _ The two lateral flaps are sutured over the axial flap, raw surface to raw surface. Finally, the bed of the axial flap is being covered in by suturing together the opposite margins in the median line.

had time to unite its pedicle is divided – the adjacent irregularities are trimmed and united by suture or allowed to granulate. The bed of the fistula is here formed of skin.



Fig. 4948.—Loumeau's Urethroplasty for Urethral Fistula of the Penile Urethra – I; – A square of cutaneous covering, the center of which is the fistulous opening, has been excised and discarded. The margins of the fistula, at the junction of the head and body of the penis, are now being freshened. A single median flap is shown mobilized.



Fig. 4949.—The Same – II; – The lips of the fistula, following excision, are brought together in the median line.

Closure of Penile Fistula by Median Glided Flap (Loumeau).—A rectangular area of skin is removed from the site of the fistula, the center of



Fig. 4950.—The Same – III; – The displaced flap is sutured into position along its three free sides – being glided forward over the denuded area.

the area of discarded skin being the fistula. The margins of the fistula are then excised (Fig. 4948), and the freshened surfaces brought together by buried, non-penetrating, fine catgut sutures (Fig. 4949). A median flap, of a size

calculated to fill the gap, with its pedicle toward the base of the penis, is then raised and mobilized considerably beyond its base _ after which it is glided forward and sutured into the denuded area (Fig. 4950).

Closure of Penile Fistula by Inverted Flaps (Doyen).—Having introduced a soft-rubber catheter, an elliptic area of skin, of which the fistulous opening is the center, is incised into the areolar tissue _ the size of the ellipse being such by careful calculation as to furnish a sufficient surface between the margins of the fistula and the line of elliptic incision for inversion (Fig. 4951). The outer aspects of the oval of freed tissue are mobilized toward the fistulous opening _ but, most carefully, only to a limited extent, sufficient simply to turn the borders of the ellipse inward, hinging the parts upon the

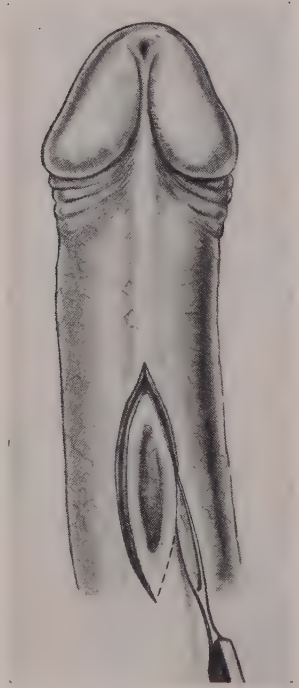


Fig. 4951.—Closure of a Fistula of the Penile Portion of the Organ by Inverted Flaps _ I; _ Incising the skin elliptically just outside of the defect.

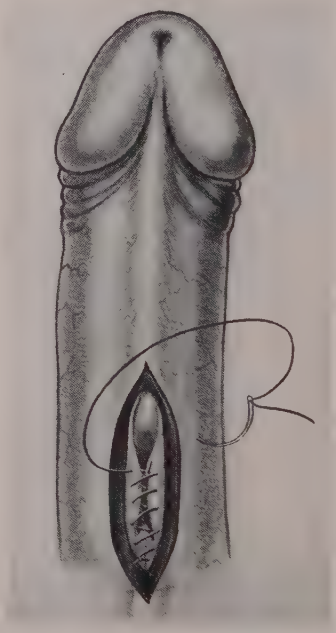


Fig. 4952.—The Same _ II; _ Suturing together the margins of the inverted flaps.

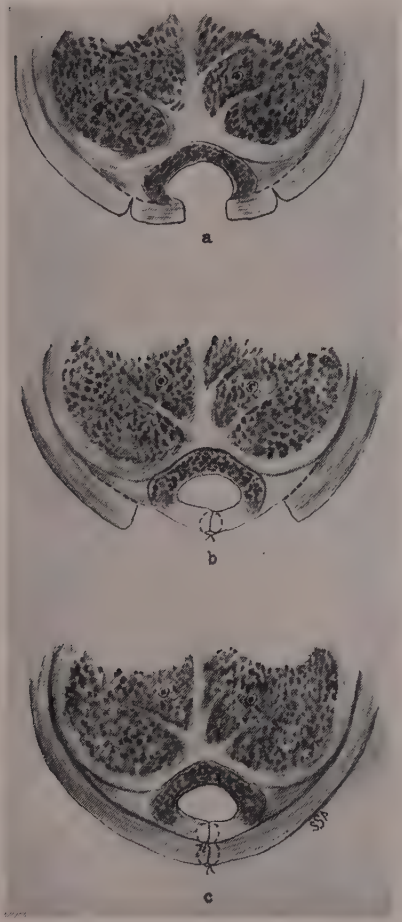
yet attached tissue between the outline of mobilization and the undisturbed margin of the fistula. The mucocutaneous margins of the freed ellipse are then turned inward and sutured with fine chromic catgut (Fig. 4952). Finally, over this raw surface is drawn and sutured the mobilized margins of skin.

In common with all the operative procedures above mentioned _ the technic is more readily performed while the urethra is distended by a soft-rubber catheter _ and the question of temporary bladder drainage during the safe cicatrization of the operative wound must be provided for _ either by an in-dwelling catheter, or suprapubic cystotomy drainage (v. p. 554).

Sectional views of the above steps are shown in Figs. 4953–4955.

Closure of a Large Fistula by Reversed Flaps (Zymanowski).—A vertical incision is made immediately next to the free margin of one side of

the fistula, beginning and ending about 1.3 cm. ($\frac{1}{2}$ inch) above and below the upper and lower limits of the fistula (Fig. 4953, **a, b**). By undercutting in the connective-tissue plane the flap **c** is freed back to the curved dotted line. To the opposite side of the fistula, and sufficiently far from it to plan a flap



Figs. 4953–4955.—Operation for Penile Fistula Where Difficulty is Experienced in Bridging the Mucosa: – a, Two incisions are made parallel with the furrow and its outer sides – from which the skin is undercut inward and outward. b, The skin flaps bordering the furrow are inverted and sutured together, forming the floor of the new urethra. c, This new floor is reinforced by sliding the superficial, mobilized skin-flaps from the two sides over the inverted flaps.

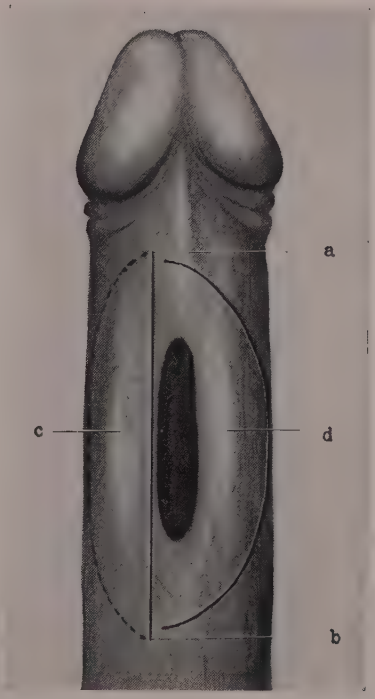


Fig. 4956.—Zymanowski's Plastic Closure of Large Urethral Defect – I: – a, b, Vertical incision extending above and below fistula and passing near it; – c, flap to be freed back to the dotted line; – d, denuded flap raised at the side of the fistula, but not as far as the fistula.

which will, when reversed reach to the dotted line, a second curved incision is made so as to outline a flap (from whose surface the epithelium has been cureted) with an inward hinge, the curve not extending quite as far above or below as the vertical incision (v. Fig. 4956, **d**). The flap, **d**, is then mobilized, in the connective-tissue plane nearly up to but not quite to the margin of

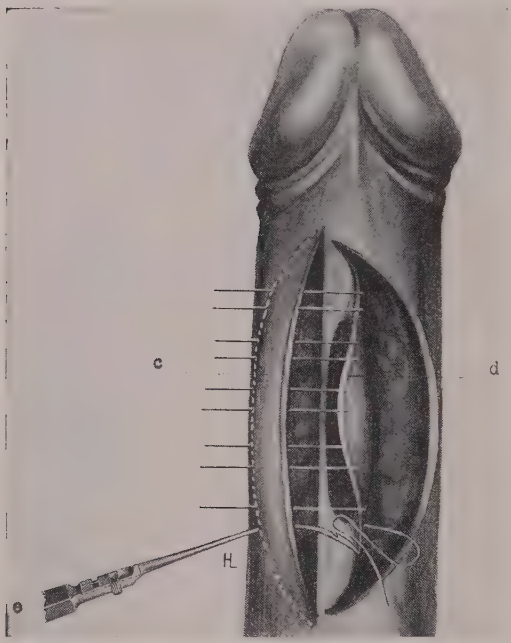


Fig. 4957.—The Same – II; – Mattress-sutures, with loop on the skin surface, have been placed near the free border of the flap, d – and then passed, by Reverdin needle, e, through the attached base of the flap, c, thereby folding the flap, d, over the fistula, skin downward (inward). The raw surfaces of flaps c and d are thus approximated.

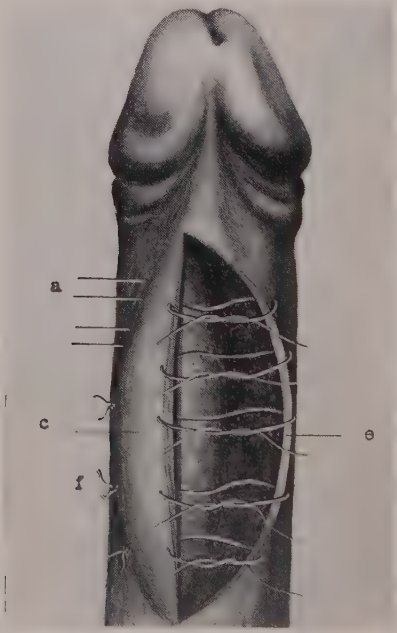


Fig. 4958.—The Same – III; – The mattress-sutures, a, have been drawn tightly and tied, f, inverting the skin surface of the flap, d (Fig. 4957), beneath the flap, c. Sutures then unite the free border of flap c to the margin e, from which flap d has been raised.

the fistula. When this has been accomplished a Reverdin needle carries a series of mattress-stitches from the outline of the dotted line, from without inward, to catch the free margin of the flap which is to be reversed (Fig. 4957, **c**). When these are all placed they are tied. (They are not shown tied as mattress-stitches in Fig. 4957 by error.) When these sutures are tightened the free margin of the flap, being reversed, is tucked in under the flap first mobilized and anchored thereby. Finally, the free margin of the original, straight-edged flap is sutured by ordinary stitches to the concave margin left by raising the convex flap that was reversed (Fig. 4958, **e**). A retention catheter or other form of bladder drainage is used during the healing of the wound.

OPERATIONS FOR FISTULÆ OF THE PERINEAL URETHRA

Closure of Simple Perineal Urethral Fistula by Excision and Suture. —In the present instance such a fistula as might result from peri-urethral ab-

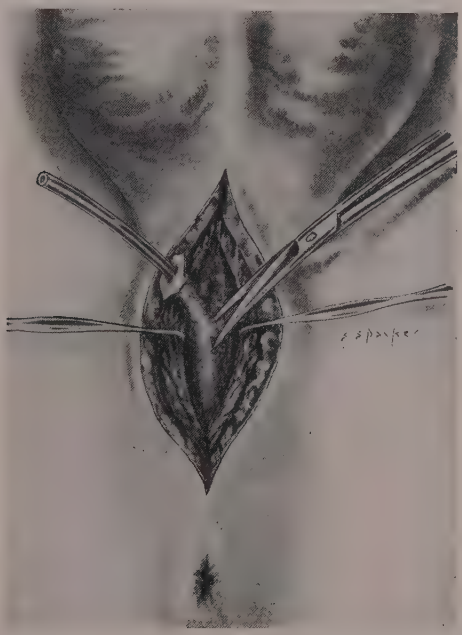


Fig. 4959.—Closure of Simple Perineal Fistula by Excision and Suture. I; A sound has been passed into the bladder from the meatus and a piece of small size rubber catheter has been carried through the fibrous fistulous tract as a guide in the dissection of the tract.

scess uncomplicated by stricture will be supposed. The procedure is much simplified if a metallic sound be carried through the urethra from the meatus and a short piece of rubber catheter be conducted through the fistulous tract, from the perineum, into the urethral lumen, until in contact with the sound (Fig. 4959). For ease in manipulation the rubber catheter may be cut flush with the skin and anchored in the margin of the fistula by a stitch. Varying with the circumstances of the case, and the thinness or thickness of the perineum, the fistula is surrounded by an elliptic incision of sufficient width to embrace its boundaries and whose ends are extended as far as necessary in the median perineal line in front of and behind the fistula. The outer aspect of the fistula is dissected free of the adjacent skin by deepening the elliptic incision. As

soon as enough of the fistulous tract is freed to be grasped, it is seized, with its included piece of catheter, by clamp forceps – and carefully followed down by dissection to its communication with the urethra – being careful not to cut into the fibrous wall of the tract on the way down. When the junction of the urethra is reached, in following down the fibrous wall of the fistulous tube, and while the parts are well retracted, the fistulous canal is excised flush with the urethra. The opening into the urethra thus left is closed by two or three buried, non-penetrating sutures of fine chromic catgut (Fig. 4960). It will depend upon the judgment of the Surgeon whether a temporary drain be carried directly to the sutured urethra or whether the immediately adjacent tissues be similarly sutured by buried stitches over the sutured urethra – and the temporary drain be simply carried through part of the depth of the wound – the excess of the perineal wound being sutured at both of its ends.

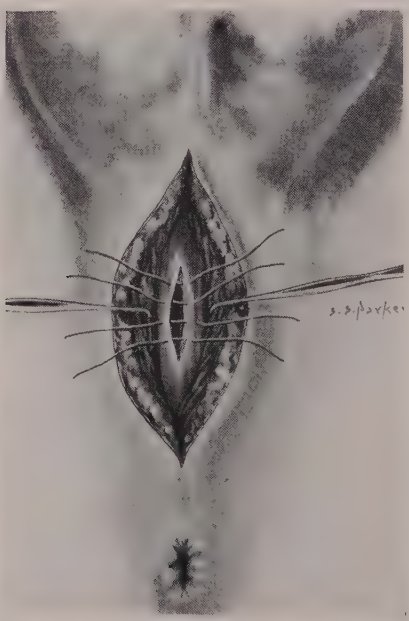


Fig. 4960.—The Same – II; – The site of the excision of the fistulous tract from the urethra is being sutured – after which the perineal wound will be closed with a temporary drain conducted down to the urethral suturing.

Even more important, in perineal fistulæ of the urethra, is the question of temporary bladder drainage – either by retention catheter or by suprapubic cystotomy suction drainage (the latter being preferred by some Surgeons).

Operation for Perineal Urethral Fistula Due to Stricture by External Urethrotomy.—The general features of external perineal urethrotomy (v. p. 649) here prevail – conducted in conjunction with the technic just described above. Presumably, a medially grooved sound can only be carried down from the meatus, through the urethra, to the anterior face of the stricture which is the cause of the persistence of the fistula. Guided by the feeling of the sound through the perineal tissues, and also by the presence of the perineal fistula, a median perineal incision is made – which may either be in the form of a single limbed straight cut, through the middle of the fistula, or, better, the incision may begin and end as a single median cut – diverging to form

a narrow ellipse just in front of and behind the fistula, so as to include it within the diverging limbs of the cut. This general technic is shown in Fig. 4961. When the groove of the sound is reached, with its tip against the anterior face of the stricture, the floor of the urethra is incised by cutting directly in the groove. This opens up the floor of the urethra just in front of the stricture. The intact roof of the urethra is then carefully followed through the region of stricture, toward the bladder, by some small calibered instrument – such as a small size of grooved director (Fig. 4962). If this can be accomplished,

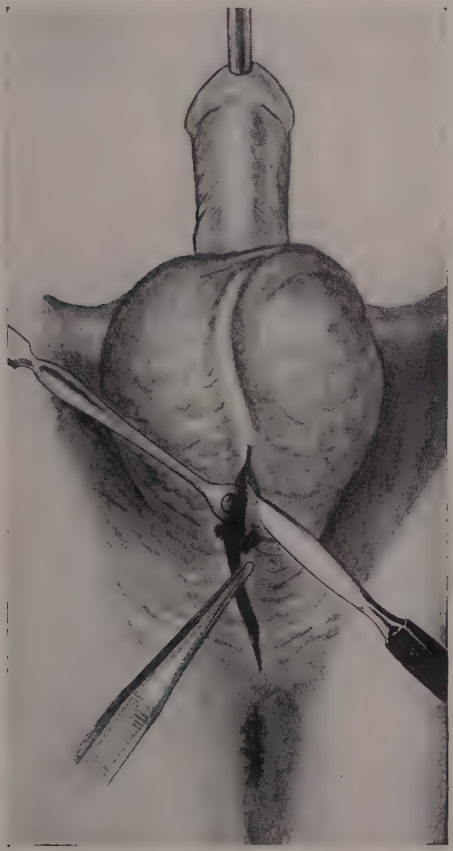


Fig. 4961.—External Perineal Urethrotomy Upon a Grooved Sound Passed Down to the Stricture, Opening the Urethra in Front of the Stricture, for Combined Stricture and Fistula – I; – An old fistulous tract, leading to the site of stricture, is here being excised. (Figs. 4961–4963 modified from Albarran.)

with sufficient room to spare, the metallic sound is withdrawn, and a soft-rubber catheter introduced from the meatus and passed down the urethra, and out through the perineal wound – after which its tip is taken in the fingers and directed upon the grooved director into the bladder (Fig. 4963). If there be difficulty in entering the bladder after the perineal urethra is laid open, then the same problems are to be met, and similarly solved, as in the case of performing external urethrotomy by a guide conducted down to the stricture (v. p. 675). If a perineal fistula exists, leading down to the

urethra, and no form of guide can be employed at all, then the same conditions are present as in the case of performing external perineal urethrotomy without a guide (v. p. 678), and must be met in the same way. If, eventually, the urethra be opened up so that the bladder can be entered, then a retention catheter is usually put into position, and the perineal wound allowed to granulate over the catheter, thus forming a new urethral floor in the gap – aided or not by suprapubic suction drainage – after, in some cases, employing the suprapubic wound for retrograde catheterization.

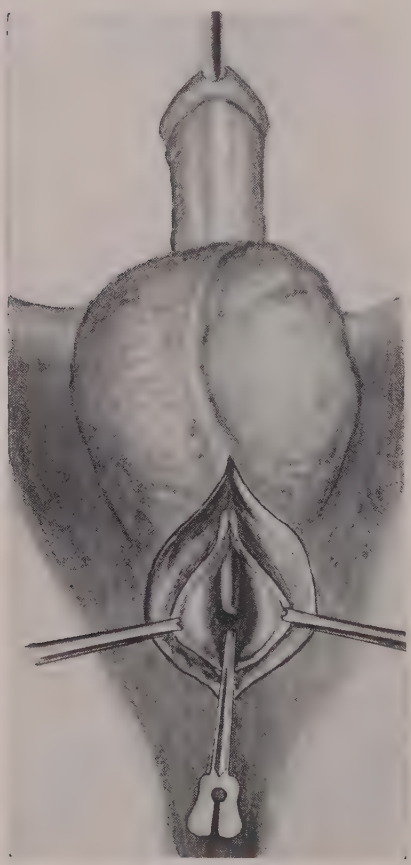


Fig. 4962.—The Same – II ;– A grooved director takes up the penetration of the deep urethra where the sound ceased to pass – and is carried on into the bladder.



Fig. 4963.—The Same – III; – A rubber catheter passed from the meatus into the perineal wound is now passed upon the grooved director into the bladder by manipulation in the perineal wound.

Operation for Perineal Urethral Fistula by Inverted and Superimposed Flaps (Guyon).—A limited rectangular flap whose center is the skin outlet of the fistula is excised and discarded. The fibrous fistulous canal is dissected down to the urethra and excised – followed by the closure of the urethral opening by non-penetrating sutures of fine chromic catgut. A lateral flap, with its pedicle inward – and from which the hair has been previously destroyed, and which is now deprived of its epithelium, is mobilized and

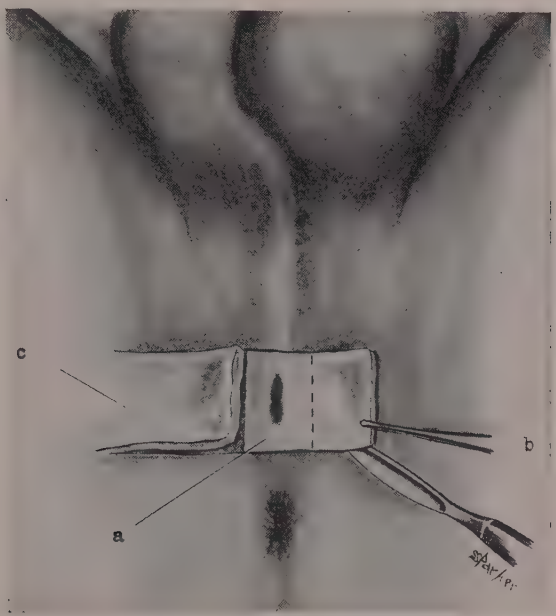


Fig. 4964.—Repair of Perineal Fistula by Superimposed Flaps (Guyon) – I: – a, Square, bounding site of fistula, ready to be excised, together with the fistulous tract; – b, smaller flap, being raised, with internal pedicle; – c, longer flap raised, with external pedicle.

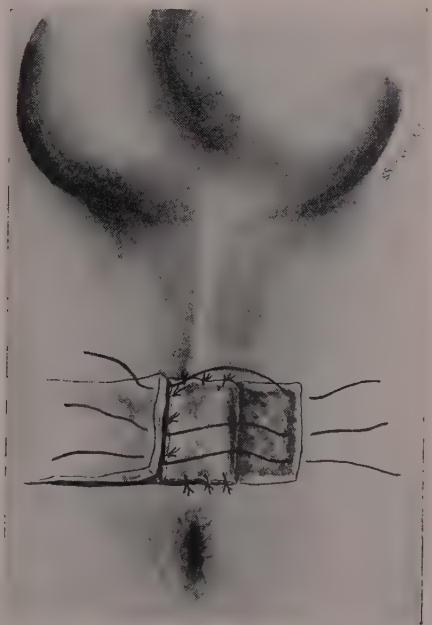


Fig. 4965.—The Same – II; – The inner pedicled flap, denuded of epithelium, is inverted along the dotted line in Fig. 4964, and sutured along the right vertical border, and upper and lower borders of the square bounding the fistula, forming the floor of the new urethra at the site of the fistula. The end sutures are placed ready to anchor the outer pedicled flap.

hinged inward, so that its raw surface is outward (Fig. 4964, **b**). This denuded inverted flap is then sutured into position in the manner and position shown in Fig. 4965. An opposite longer lateral flap is also mobilized (v. Fig. 4965) and is glided mediad, so that its raw surface is superimposed upon the raw surface of the first flap _ after which its three free borders are sutured into the corresponding margins of skin (Fig. 4966).



Fig. 4966.—The Same _ III; _ The outer pedicled flap is then sutured to the original site and to the raw surface of the smaller flap everywhere along their borders.

Note.—It is uncertain, from the descriptions at hand, whether thes quare, **a**, in Fig. 4964, is excised or simply de-epitheliated, made ready to receive the de-epitheliated surface of the flap, **b** _ as appears to be the interpretation of the original description, but which is not altogether plain.

OPERATION FOR URETHRORECTAL OR URETHRO-RECTO-PERINEAL FISTULA

ALBARRAN'S TECHNIC

If it be possible, a soft-rubber catheter (No. 18 or 19 French) is passed from the meatus, through the urethra, into the bladder _ and remains not only as a guide during operation but also as a retention catheter subsequently. If this cannot be done because of the fistula being the result of stricture, then a metallic sound is first passed through the urethra _ and then, at the end of the operation, the retention catheter is placed.

If the case be one of urethro-recto-perineal fistula, one opening will be upon the perineum.

The approach is made by two incisions combined. A slightly curved incision with posterior concavity is carried transversely across the perineum, from one ischial tuberosity to the other _ passing between the anus and the retrobulbar face of the urethral bulb. (This incision is shown too short in

the picture.) To this is added a median perineal incision about 5 or 6 cm. ($2\frac{6}{16}$ inches) in length.

These incisions are deepened and the bulb of the urethra exposed. With this as a rallying point, and the known position of the skin opening of the fistula (the latter giving only an approximate idea of the direction and course of the fistulous tract, however), the perineal urethra is traced toward the bladder until the fibrous tube of the urethrorectal fistula is encountered, passing backward from the urethra between the bulbocavernous muscles. By careful dissection the urethral opening, the rectal opening, and the intervening course of the fistulous tract are fully exposed. The fibrous tube of the fistula, unopened, is isolated throughout its course between urethra and

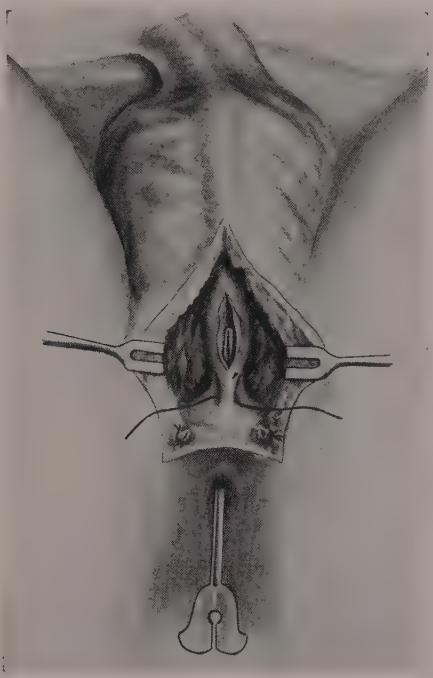


Fig. 4967.—Operation for the Repair of a Urethrorectal Fistula _ Albarran _ I; _ The site is exposed by median incision with a curved, transverse cut, convexity forward, at its bottom. A grooved director may be passed through anus and rectum, into the urethra, through the fistulous opening, in which its tip is seen _ and which tract originally (before the incision) opened upon the perineum, as shown in the sides of the median cut. A ligature passes behind the fistulous tract near its communication with the rectum. (Illustrations 4967–4969 modified from Albarran.)

rectum. In proportion as the fistulous tract is well defined and of manipulable length, so is the technic easier _ and *vice versa*. In difficult, complex cases, where the fistula has diverticula, and where the anatomic structures are not readily demonstrable, the procedure may be much complicated. If the fibrous tube be somewhat long it should be ligated very close to the rectum (Fig. 4967), and divided just beyond the ligature. If the fistulous tube, on the other hand, be very short, it should be divided nearer the urethra. In the latter instance it may not be always possible to previously ligate it. The special object is to secure sufficient length of the rectal aspect of the fistulous tract for closing, and for safely burying within the rectum by inversion. Where the fistulous tube is ligated the rectal end is then buried, by Lembert

sutures, within the wall of the rectum – as is the stump of the appendix. Where no room for ligature previous to division exists, then the rectal outlet of the fistula is previously clamped, if possible, with appropriate curved clamps, and divided – after which the margins of the rectal opening are first sutured together by through-and-through sutures – and then this first tier of suturing is buried by a tier of Lembert stitches. The application of the Lembert sutures in either case is shown in Fig. 4968.

The opening in the urethra, from which the urethral end of the fistulous tube has been cut, is closed by non-penetrating sutures – applied as shown in the picture last quoted.

The field of operation, with the fistulous tract excised, and the rectal and urethral ends of the fistula closed by suture, is seen in Fig. 4969.



Fig. 4968.—The Same – II; – The rectal end of the fistula has been ligated and inverted into the rectum, the site being closed by Lembert sutures. The urethral end is excised and the lips of the freshened urethral orifice closed by non-penetrating sutures.

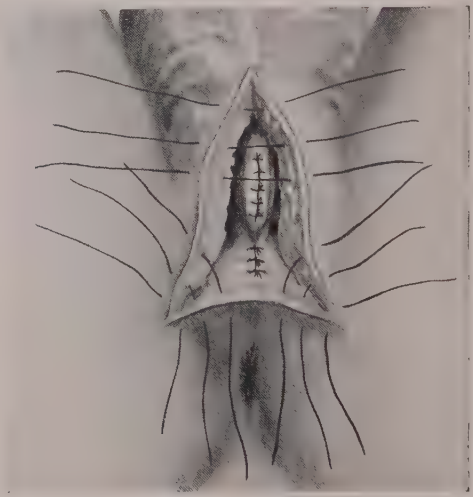


Fig. 4969.—The Same – III; – The urethral and rectal orifices are shown sutured. Superficial sutures are about to close the skin wounds at their ends – leaving the central parts unsutured for drainage.

In conclusion, the wound may be treated in various ways. In favorable cases the extreme ends of transversely curved and median perineal wounds may be sutured, and one temporary drain be carried down to the urethral wound and another to the rectal wound. Again, the median perineal wound is sometimes entirely closed – and the double drainage accomplished through the transversely curved wound, the extreme ends of which may be sutured.

Temporary bladder drainage by retention catheter or suprapubic suction drainage is necessary.

OPERATION FOR COMMON URETHRORECTAL CLOACAL OUTLET UPON THE PERINEUM

ALBARRAN'S TECHNIC

Description.—In these cases the outlet from the bladder and the outlet from the rectum open in a common perineal depression – urine and feces often intermingling – the urethra here opening upon the periphery of the

rectal orifice. The object of the operation here considered is first to isolate each opening – thereby constituting an independent orifice for the passage of the bladder contents – and a separate one for the transmission of the bowel contents – each being independent of the other, though in the same vicinity – and, subsequently, to close the urethral fistula.

The case in which the present technic was worked out was one in which the condition was the result of traumatism involving the rectum and membranous urethra – and the procedure was carried out in two stages. In the first stage the common opening is converted into two independent openings –

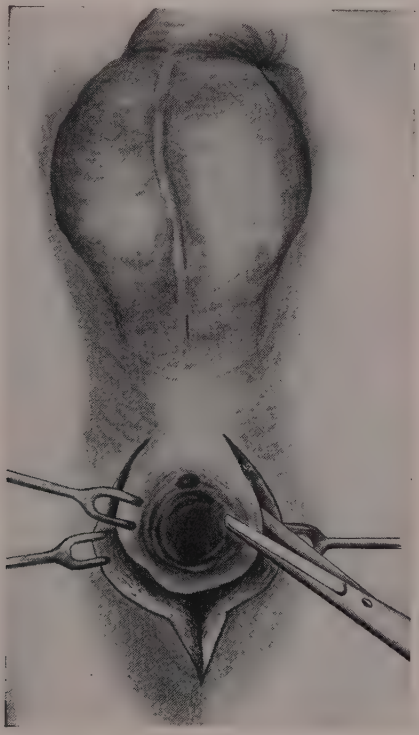


Fig. 4970.—Operation for Recto-urethral Cloaca in the Male – I; – The common rectal and urethral opening is shown – which is surrounded by an incision passing through about three-quarters of its circumference, with a median extension posteriorly. This original circle is planned to form two secondary circles of, approximately, one-third the tissue consumed in making the new urethral orifice, and two-thirds in making the new anal orifice. Scissors are seen dividing the cloacal outlet. (Figures 4970–4972d modified from Albarran.)

rectal and urethral. At the subsequent operation, following healing of the two structures, the urethral opening is closed by plastic operation.

A U-shaped incision is carried around the anus, with its base posteriorly – the line of incision running outside of the sphincter. From the middle of the base of the incision a median incision is extended to the coccyx. These incisions are everywhere deepened – and through them the rectum is isolated from the skin to a level above the fistulous communication between the urethra and rectum. After the rectum has been freed throughout, nearly in its entire circumference, it is divided, by scissors, into an anterior and a posterior portion (Fig. 4970). In making this section of the rectum, while the division makes

an anterior and a posterior half at the skin level of the rectal outlet, the scissors are so directed in making the cut that the two sections of the bowel meet upon the anterior wall of the rectum above the level of the fistulous communication _ thus giving the form of a reversed V (the apex of which is upward) _ thereby making the subsequent steps of the two independent closures possible. The anterolateral wall of the rectum, out of which the new temporary urethra is to be formed, is thus entirely separated from the rectum proper.

The temporary urethra is formed by turning and suturing together the inverted V-shaped anterior half of the rectum together in the manner shown

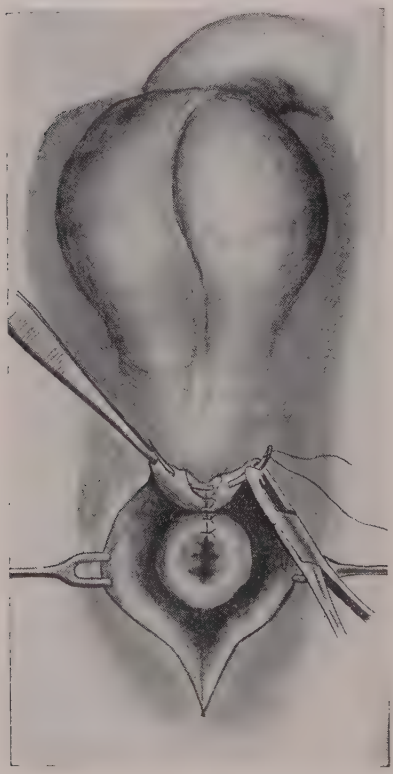


Fig. 4971.—The Same _ II; _ The posterior portion of the rectum has been united to form the new anorectal opening, and the anterior portion of the rectum is being closed to form the temporary urethral orifice.



Fig. 4972.—The Same _ III; _ New urethral and rectal openings completed and the posterior median incision closed.

in Fig. 4971 _ and as seen completed in Fig. 4972. The urethral fistula now opens, below, independently upon the perineum _ and, above, communicates with the prostatic urethra _ communicating directly with the bladder. It will be noticed in forming the new temporary urethral outlet that the tissue of the anterior half of the rectum *appears* to be twisted in an unnatural direction, but this is only apparently so, and is caused by the position in which it is held for the convenience of suturing.

To reconstruct the rectum and anus the posterior half of the divided rectum is made to form a smaller rectal tube by having its borders sutured together (v. Fig. 4971) _ the right and left sectioned border being sutuerd

together anteriorly. It is the reversed V-shaped section of the bowel which makes the construction of these two independent canals, urethral and rectal, possible.

After each canal has been constructed and made to open independently upon the perineum, the periphery of each canal is sutured to the adjacent skin, and the median perineal incision is closed (v. Fig. 4972). A temporary drain may be employed in the region between the two canals.

When the wounds are healed the patient will have a urinary fistula opening immediately in front of the anus, and its anterior end opening into the urethra at about 3 cm. ($1\frac{3}{16}$ inches) in advance. This fistulous tract is subsequently closed by plastic operation – as though it existed alone – several technics for which have been described. Albarran employed a double flap method for this closure.

OPERATIONS FOR EPISPADIAS, IN GENERAL

This condition consists in a congenital deformity, characterized by an absence of a part, or of the entire roof of the urethra – the urethra opening upon the upper (rather than lower) aspect of the penis in some position posterior to its normal site. The explanation as to why the urethra should be embryologically transposed from below to above the corpora cavernosa is not definitely known.

This condition occurs much less frequently than does hypospadias, but is far more difficult to treat. While exstrophy of the bladder is always associated with epispadias, the latter is not necessarily always accompanied by ectopia vesicæ, although the two conditions almost always occur together.

The varieties of epispadias may be grouped as follows: – glandular (involving the glans penis) – penile (involving the spongy urethra) – spongioglandular (involving both the glans penis and the penile or spongy urethra) – and complete epispadias (in which the urethra is involved from the meatus to the pubes).

In proportion as the individual case is complicated, especially by ectopia vesicæ, are the difficulties of surgical aid increased. Where this combination exists a vesical sphincter cannot be formed, so that all that is sought is to form a penile tube which will conduct urine, passively, to a permanently worn urinal (Walker). Where complete epispadias exists, even independently of exstrophy of the bladder, the penis itself is rudimentary, so that the chance of surgical relief is exceedingly poor.

The two general types of operation usually applied to these distressing cases is either the approximation of the denuded margins of the epispadiac groove, or the resort to some more or less complicated form of plastic procedure.

OPERATIONS FOR EPISPADIAS

Duplay's Operation for Epispadias.—The operation is performed in several stages, the number and details of which will be modified by the circumstances of the special case.

Stage A: If adhesions or accompanying deformities of the penis exist, independently of the epispadias, these are first corrected. Adhesions binding the penis to the pubic or to the abdominal wall are divided subcutaneously. The penis is then kept strapped down into a more normal position, sometimes for a number of months, before the next stage.

Stage B: A perineal fistula is made – as a safety urinary drainage posterior to the site of operation – to enable the field of plastic operation to be kept dry during healing. This is accomplished by median perineal section, and

the steps are just the reverse of those for the closure of a perineal urethral fistula in so far as the urethra is concerned.

Stage C: Two long, narrow, parallel quadrilateral areas, such as shown in Fig. 4973, are denuded upon the dorsal aspect of the penis, extending from the abnormal urethral opening to the end of the furrow (which may terminate upon the body or upon the glans, of the penis) the width of denudation being about 5 mm. (3/16 inch). A firm-walled rubber catheter, extending from the abnormal opening to the end of the epispadiac furrow, is then placed in the middorsal groove, and the two areas of denudation are sutured together over the rubber catheter (Fig. 4974).



Fig. 4973.—Duplay's Operation for Epispadias.—I;—Two parallel areas are denuded from the peno-abdominal epispadiac opening on to the glans penis.

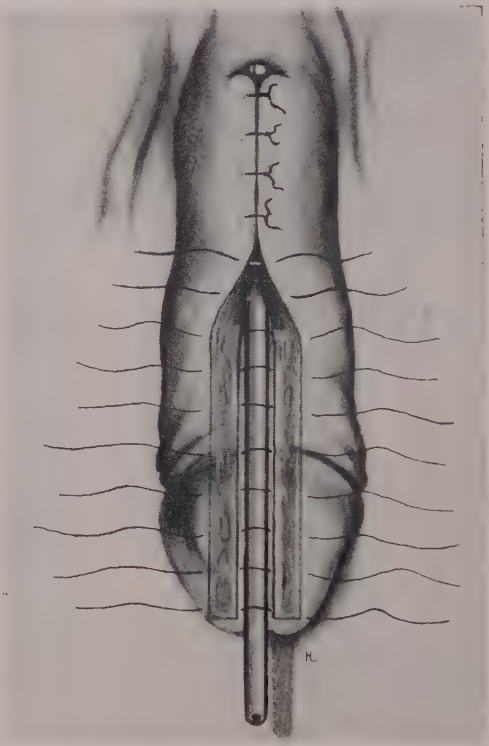


Fig. 4974.—The Same.—II;—The two raw surfaces are then sutured over a rubber sound. If not indicated to do so at the time, the epispadiac opening is closed subsequently.

Stage D: The prepuce, if misshapen, is, after the healing of the major operation, shaped and adjusted as indicated in the special case. The prepuce is usually redundant, hanging hood fashion below the glans—and the manner of meeting this deformity is, ordinarily, to slit the prepuce vertically and to pass the head of the organ through this slit—after which the anterior border of the new roof formed for the canal and the border of the prepuce, brought over the head of the penis, are freshened and sutured together.

Stage E: The epispadiac opening upon the dorsum of the penis is freshened and closed by suture—making continuous the passage from the bladder to

the new meatal opening. A perineal or suprapubic retention catheter is kept in position during the healing of this plastic procedure.

Instead of making a perineal fistula to divert the urine during healing, sometimes the catheter upon which the penis has been repaired is passed directly into the bladder through the epispadiac opening.

Where perineal drainage or suprapubic suction drainage is provided in advance, a glass rod or a solid rubber bougie is sometimes used as the form over which the denuded sides of the groove are sutured.

The Duplay operation is based upon the fact that in this condition of epispadias the corpora cavernosa are not firmly united, but are united by a less

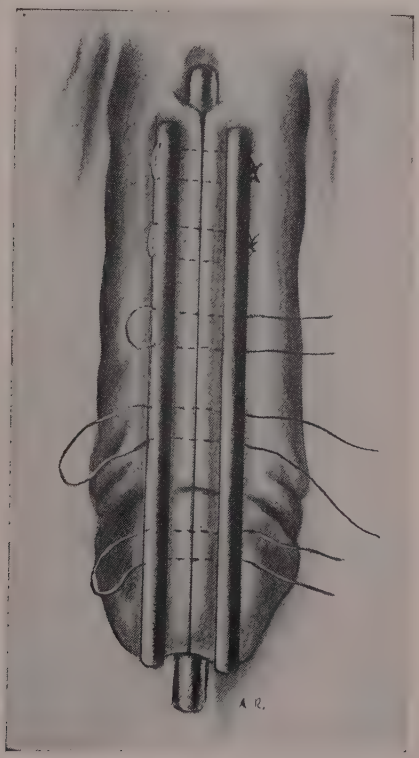


Fig. 4975.—Union of the Denuded Areas in Duplay's Operation for Epispadias by Quilled Sutures or Perforated Rods.

complete fibrous septum – which circumstance makes feasible the depression of the parts between the corpora cavernosa, to form the floor and part of the sides of the new urethral canal. A median incision may be made to deepen the furrow between the two corpora cavernosa.

Some form of quilled suture is generally employed – especially where the groove is very shallow – the technic being as shown in Fig. 4975.

Rosenberger's Operation for Epispadias.—This method of procedure may be especially employed where the epispadiac opening is of limited extent rather than a long furrow running the length of the penile urethra. The operation is performed in two stages:

Stage A: The epispadiac opening is freshened, and a somewhat broad area of the surrounding dorsum of the penis is denuded in rather an oval

outline – and a corresponding area of the abdominal wall is similarly denuded, in such position as shown, by trial, to exactly and easily correspond with the denuded oval upon the penis, so that there will be no tension upon the

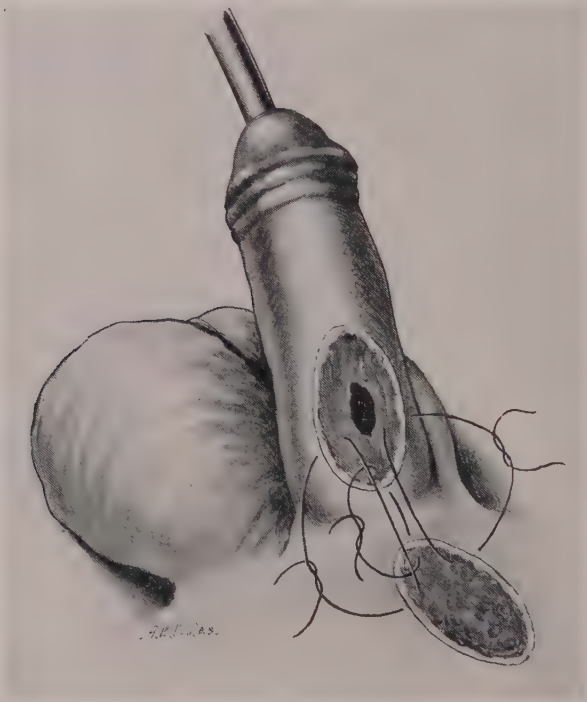


Fig. 4976.—Rosenberger's Operation for Epispadias – I; – The denuded area surrounding the penile fistula is ready to be temporarily sutured to a correspondingly denuded area upon the pubo-abdominal wall. (This technic is also credited to Bessel and to Hagen.)

parts in the subsequent manipulations. The surfaces thus prepared for approximation are shown in Fig. 4976. When all is in readiness the raw surfaces are brought into relation, and are sutured together by stitches which take

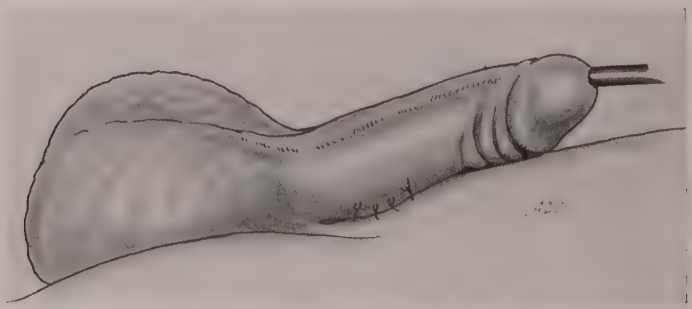


Fig. 4977.—The Same – II; – The denuded areas sutured together – as seen in cross-section.

a broad hold of the opposite raw tissues – the stitches passing well into these raw areas. The parts, as finally sutured, are shown in Fig. 4977. The penis is held in this position by strips of zinc-oxid plaster – and erection during heal-

ing is avoided – as well as wetting of the part by urine (which has been provided against by temporary perineal fistula or by suprapubic cystotomy drainage).

Stage B: When union is complete the penis is cut away from the abdominal wall, together with some of the skin and connective tissue of the part – carefully avoiding accidentally opening into the epispadiac tract. The raw surface upon the penis may be grafted – and the oval area upon the abdomen can be covered by mobilizing the surrounding skin and bringing the margins together by suture.

Beck's Operation for Epispadias.—The special feature of this procedure is that the new urethral canal is lined with mucosa in whole or in part – according to the amount of available mucosa obtainable from the bladder outlet.

An incision, of the outline shown in Fig. 4978, is carefully planned – the object of which is to furnish a funnel-shaped mucous or mucocutaneous bag out of which the penile urethral canal is to be formed. The calculations



Fig. 4978.—Beck's Operation for Epispadias – I; – The epispadiac opening is seen near the abdominal junction. The flap to be raised is outlined by incision.

must be very carefully made. The curved portion of the incision over the region of the symphysis pubis must extend sufficiently far upward so that there will be enough loosened mucocutaneous tissue to reach forward to the tip of the glans penis, for out of it is the roof of the new urethra to be formed. The mucocutaneous tissue of which the floor of the urethra is to be formed is represented in its center by the floor of the groove. The width of the funnel of tissue to be raised, formed by the two parallel axial incisions, must be accurately calculated. The parallel cuts are connected, anteriorly, by a transverse cut placed just posterior to the position of what would be the normal corona glandis.

The funnel of mucocutaneous tissue is now mobilized by careful cutting by means of curved Mayo scissors, in the connective-tissue plane, and by blunt dissection. As this mobilization approaches the bladder outlet the Surgeon places the tip of his left index-finger within the epispadiac opening – so

that during the rest of the freeing of the bag-like flap toward the bladder he will not buttonhole the structure out of which the new urethra is to be made. As the tissues are freed they are drawn forward – and no attempt is made to accomplish the final steps of the operation until it is ascertained that sufficient length of tissue has been secured to make the reach without too great tension. This may be tested in the manner shown in Fig. 4979. Finally, an opening is cut in the face of the glans penis in the position usually occupied by the meatus – and this opening is tunneled through the glans and between the forward ends of the cavernosa. Through this opening the blades of a pair of slender forceps are carried – the grouped together margins of the bag-like tissues seized – and drawn forward through the head of the organ (Fig. 4980). The free edges of the funnel of mucosa and skin are then sutured into the margins of the opening made upon the face of the glans. In conclud-

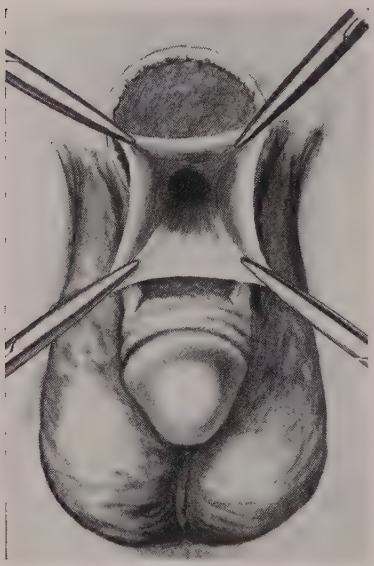


Fig. 4979.—The Same – II; – The outlined peno-abdominal flap, grasped by forceps, is mobilized up to near the urethral opening.

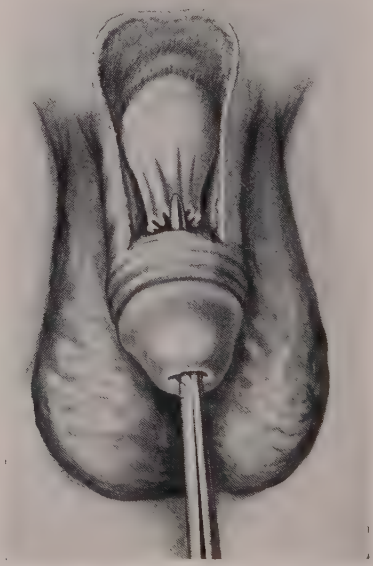


Fig. 4980.—The Same – III; – The gathered together free ends of the peno-abdominal flap, into which the epispadias opens, are drawn through the tunneled glans – to be anchored upon its surface.

ing the operation the margins of the skin, upon penis and symphysis pubis, bordering upon the limits of the cut, are mobilized and brought together by suture – in so far as this is possible – and whatever surface cannot be so covered is grafted.

In the descriptions of this operation which are immediately available no mention is made as to what provision is made against the scraggly hair which may limitedly, in these cases, occupy the tissues which are to be used for the new urethral canal in those cases where these tissues must be formed of skin covered by pubic skin. Presumably the hair bulbs are previously destroyed electrolytically.

Thiersch's Operation for Epispadias.—This technic is characterized by superimposed flaps, for the formation of the new urethral canal, besides the secondary operations upon the glans penis, prepuce, and fundus of the

epispadiac opening _ and is applicable both to cases of simple epispadias and to those associated with exstrophy of the bladder. The operation is conducted in four stages _ extending over several months.

Stage A _ Formation of the New Urethral Flaps: These flaps are outlined as shown in Fig. 4981 _ and are mobilized in their connective-tissue plane _

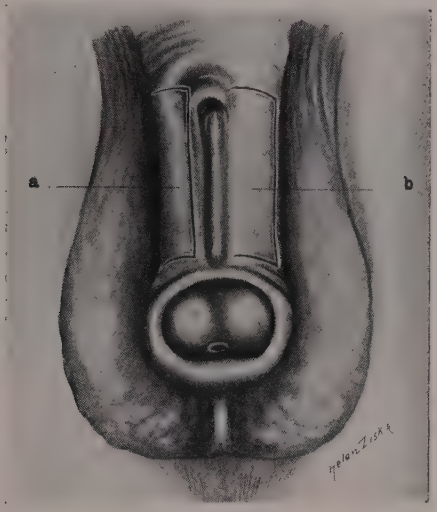


Fig. 4981.—THIERSCH'S OPERATION FOR EPISPADIAS _ I; _ Two flaps are outlined, both hinging to the right: _ **a**, The right, attached upon the lateral aspect _ and **b**, the left, attached medially.

flap **b** is to be inverted, skin inward _ and flap **a** is to be glided over it, bringing raw surface to raw surface. A sectional view of these flaps and their undercutting is seen in Fig. 4982. They begins near the base of the penis, posterior to the proximal beginning of the epispadiac opening _ and end, anteriorly, just behind the position of the normal corona glandis. The width of these flaps will depend upon the needs of the individual case, but they should be

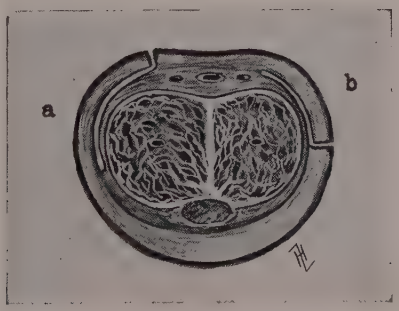


Fig. 4982.—The Same _ II; _ Cross-section of Fig. 4981; _ Flap **a** hinging laterally to the right _ and flap **b** hinging medially to the right.

broad enough to cover the parts, as intended, without tension. The axial cut of flap **a** is parallel with the bed of the furrow and immediately next to it. The axial cut of flap **b** is upon the anterolateral aspect of the body of the penis, parallel with the axial flap of the opposite side. The ends of both flaps are freed by transverse cuts corresponding with their widths. When both

flaps are completely mobilized in their connective-tissue plane flap **b** is inverted and its free border sutured into the connective-tissue bed at the limit of the freeing of flap **a** _ by means of a Reverdin needle _ the line of sutures

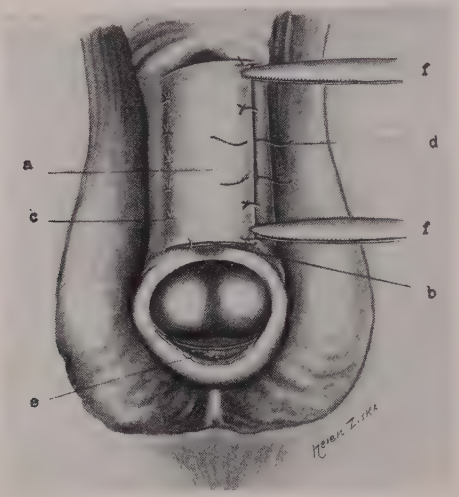


Fig. 4983.—The Same _ III; _ Flap **a**, of Fig. 4981, has been raised and temporarily turned outward to the right (its temporary position not being here shown); _ flap **b**, of Fig. 4981, has been raised, turned medially to the right, thus presenting its raw surface uppermost, and sutured to the raw surface bed of flap **a**, at its junction with the penis, by mattress-sutures, **c**, introduced by Reverdin needle. Forceps, **f, f,** draw the edges of flap **a** well to the left, where it is being sutured to the skin margin at **d**, from which line the flap **b** has been cut. The redundant prepuce has been buttonholed, **e**, posteriorly, preparatorily to using it to cover the glandular portion of the epispadias.

being seen at **c**, Fig. 4983. Flap **a** is then glided over flap **b**, so that the raw surfaces of each will be in contact _ after which the border of flap **a** is sutured, by ordinary or Reverdin needle to the margin of the skin from

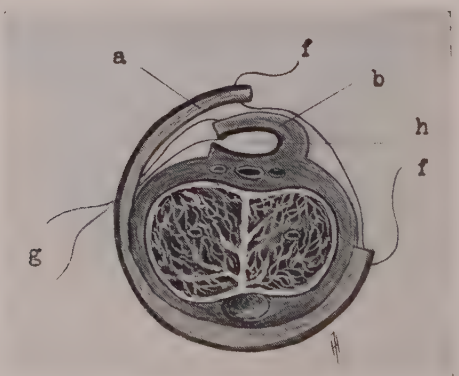


Fig. 4984.—The Same _ IV; _ Cross-section of Fig. 4983: _ **f, f,** Suture drawing flap **a** over and onto bed originally occupied by flap **b**; _ **g,** suture drawing displaced and inverted flap **b** beneath the covering flap **a** _ its turned-in skin surface forming the roof of the future urethra, **h.**

which **b** was raised. Flap **b**, in other words, is turned over and tucked under flap **a**. A sectional view of this arrangement of the flaps with their anchorage and the new urethral canal is seen in Fig. 4984. Solidification of these parts

is allowed to occur before proceding with the next step. Previously performed perineal fistula or suprapubic drainage will have provided for keeping the new canal free of urinary wetting.

Stage B _ Repair of the Anterior End of the Epispadiac Groove: A transverse incision is made in the redundant hood of prepuce which usually sags beneath the glans penis (v. Fig. 4983, e) _ after which the head of the penis is drawn through this slit and the raw border of prepuce is stitched to the freshened margin of the anterior end of the epispadiac groove (Fig. 4985), thus solidifying the anterior aspect of the defect by roofing over the small defective area there. The surfaces to which the raw portion of the slit prepuce is sutured are the freshened anterior ends of the flaps which were formed in the first stage of the operation.

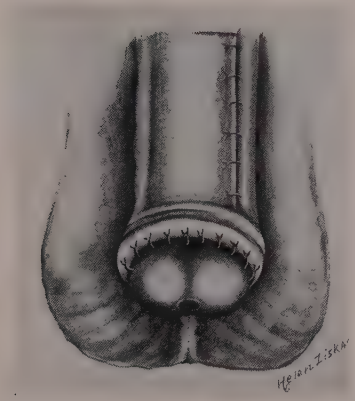


Fig. 4985.—THIERSCH'S OPERATION FOR EPISPADIAS _ V; _ Closure of defect between glans penis and new roof of urethra; _ the buttonholed prepuce (v. Fig. 4983) is brought over the glans penis (the latter slipping through the opening) to the dorsum of the penis, behind the corona _ which is anchored by sutures to the glans. The overlapping penile flap is sutured to the lateral aspect of the penis.

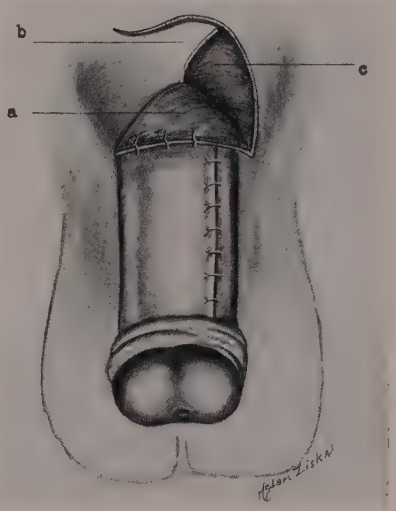


Fig. 4986.—The Same _ VI; _ Closure of defect between pubic wall and new urethral roof; _ a, Right triangular flap raised from the pubic region and doubled back upon itself, to be sutured to the freshened upper margins of flap forming the new urethral roof; _ b, right triangular flap to cover the left inverted flap and defect, c, left in its bed.

Stage C _ Repair of the Posterior End of the Epispadiac Groove: The posterior borders of the epispadiac groove and urethral canal left at the end of the first step of the operation are freshened. Two triangular flaps are next formed _ one of which is to be inverted into the defect _ and the other to be superimposed upon the first. These flaps are raised from either side of the base of the penis, reaching upward over the surface of the symphysis pubis (the hair bulbs of which should have been previously destroyed). The left flap (Fig. 4986, a) is mobilized and turned downward, with its raw surface outward, and its transversely running free border is sutured to the freshened margins of the epispadiac defect, and to freshened posterior borders of the flaps which were raised in forming the new urethral canal in the first stage (Fig. 4987). The right flap (v. Fig. 4986, b) is mobilized and glided over flap a, its transverse margin being sutured to the margin of flap a (v. Fig. 4986) _ thus approximating raw surface to raw surface. A small area of raw

surface is usually left where the flaps were raised – and this can usually be covered in by suturing the margin of the bed to the margin of one of the flaps (v. Fig. 4986).

In those cases in which there is no urethra passing through the glans penis and opening upon its surface one must be formed – and, when this is the case, the formation of the glandular urethra constitutes the *first* stage of the entire undertaking – the other steps following in the order above given.

Formation of the Glandular Urethra and Meatus in those cases in which it is absent, as the first Stage of Thiersch's Operation, just described: Two converging incisions are made into the glans penis, through three-fourths of its thickness (Fig. 4988) – the incisions beginning, on the surface, in a position corresponding with each lateral boundary of the urethral gutter. Just adjacent to and outside of, these two glandular incisions the surface of the glans is freshened parallel with the incisions (Fig. 4989). The middle portion of the glandular tissue, bounded on each side by the cuts, is then depressed by a catheter, while the adjacent raw surfaces of the glans, above the catheter, are brought together by sutures (Fig. 4990). Sometimes a harelip pin is also employed in the approximation of these glandular lips.

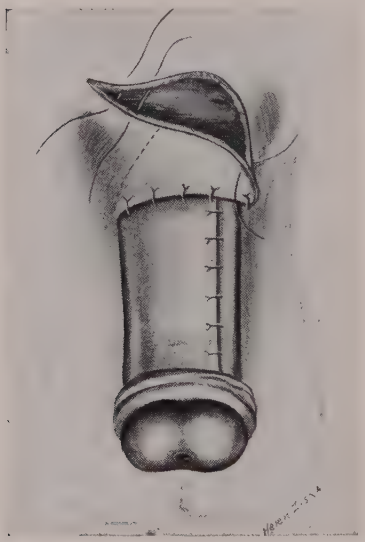


Fig. 4987.—The Same – VII; – Closure of defect between pubic wall and new urethral roof; – right triangular pubic flap slided down over the inverted raw portion of the left flap, to whose lower border it is sutured – its upper border being sutured to the margin of the gap left by raising the left flap.

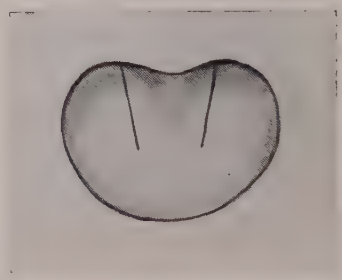


Fig. 4988.—The Same – VIII; – Where no glandular urethra exists; – two slightly converging incisions are made into the glans for about three-quarters of its thickness, along the limits of the urethral furrow – as seen in viewing the face of the glans.

Nélaton's Operation for Epispadias.—The new urethral canal is formed in this method by two superimposed flaps, raw surface to raw surface – the deeper flap coming from over the region of the symphysis pubis, and the covering flap being a hooded flap formed of scrotal skin, through the opening of which the penis is drawn.

Preliminary to the operation proper the hair bulbs of the symphysis pubis region, from which the suprapubic flap is to be raised, should be destroyed by electric needle or otherwise. The penis, if crooked, should also be gotten as straight as possible. Bladder drainage by perineum or suprapubically is also provided for in advance of the operation upon the urethra. Sometimes the penis, in cases where it is difficult to keep it straight, is held straight upon a piece of specially provided board, during and after operation.

Two parallel axial incisions, bounding the epispadiac groove, are made

down the dorsum of the penis, extending from the abdominal wall to the corona glandis – and transverse incisions (Fig. 4991) are made, outward,



Fig. 4989.—The Same – IX; – The same as Fig. 4988, seen from the upper surface, showing the two converging incisions and the central depressed portion.

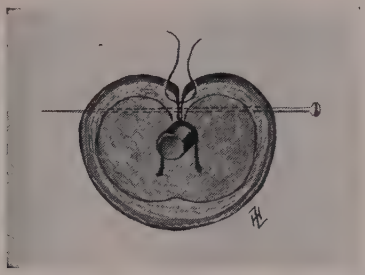


Fig. 4990.—The Same – X; – The central portion of the glans is forcibly depressed by a piece of solid rubber cord, urethral size, held in place by a transversely piercing pin. The denuded portions of the glans are united by suture.

from their ends, about three lines in length. The two lateral flaps thus outlined are mobilized in their connective-tissue plane. A third flap is raised



Fig. 4991.—NÉLATON'S OPERATION FOR EPISPADIAS; – A catheter has been placed in the proximal urethra – the abdominal wall flap outlined – and the two lateral penile flaps raised and turned outward. The latter will be sutured over the raw surface of the former when turned down into position.

from the abdominal wall, extending from the abdominal and penial junction, as far upward, with a little in excess, to correspond with the length of the

two dorsal flaps, and broad enough for a roomy urethra. A catheter is carried into the epispadiac opening and allowed to remain *in situ* in the epispadiac groove as a form upon which to build. All three flaps are mobilized. The abdominal flap is turned downward, with raw surface outward, and skin inward, to form the roof of the new urethra — its margins being sutured to the margins of the two lateral flaps, over the distending catheter. This new roofing of the urethra should be calculated amply roomy. Provision is now made to cover in the raw surface of the abdominal flap by means of a flap raised from the scrotum. This hooded scrotal flap is raised by curved incision made upon the anterior face of the scrotum, extending from one lateral aspect of the penis to the other, and so calculated as to be of the right size to cover the raw surface of the abdominal flap which has been turned down upon the dorsum of the penis. The circular incision made around the junction of the penis with the scrotum, which lies considereably within the curved scrotal incision by which the scrotal flap is outlined, enables the penis to be drawn through the flap which was originally beneath its level — so that the scrotal flap (which should be as long as the raw surface upon the dorsum of the penis) can now be superimposed upon the raw surface of the abdominal flap, *above* the penis — so that the raw surface of the scrotal flap comes into apposition with the inverted raw flap upon the dorsum of the penis. The margins of the scrotal flap are sutured to the margins of the inverted abdominal flap.

The margins of the surface left raw by raising the abdominal flap should be mobilized and brought together by suture.

OPERATIONS FOR HYPOSPADIAS, IN GENERAL

This condition consists of a congenital defect characterized by the termination of the urethra upon the inferior aspect of the penis at some site posterior to its normal position of ending. The condition of hypospadia is usually accompanied by some degree of deformity of the penis, in which incurvation is the most frequently present defect — the downward drawing of the penis being due to the fibrous tension of the undeveloped urethra. Hypospadias occurs more frequently than does epispadias.

The varieties of hypospadias are the following: — glandular or balanitic, the most frequent (the urethra opening upon the glans or immediately posterior to it) — penile (involving the second most frequent portion of the body of the penis, either just behind the frenum, at the penoscrotal angle, or midway between these two sites) — and scrotal (penoscrotal occurring at the junction of the penis and scrotum, and perineoscrotal — the least frequent form occurring at the junction of the scrotum and perineum).

In cases in which the penis is fairly straight and the defect occurs in the neighborhood of the glans, operation may not be imperatively demanded. The reverse is the case when the patient keeps the skin of the vicinity constantly wet and eczematous, and is unable to have sexual intercourse — as frequently happens when the hypospadiac opening occurs posteriorly to the junction of the anterior and middle thirds of the penis.

Operation should be performed before puberty — usually at about six years of age, for defects near the base of the organ — and at about eight years, for those near the glans. Preliminary to the major operation several months may be spent in operative and other measures for straightening the organ.

The operation is generally simpler the nearer the glans the defect occurs — and *vice versa*.

Provision for temporary bladder drainage, either by perineal urethral fis-

tula or suprapubic cystotomy suction drainage, is usually made preliminarily to operation upon the urethra.

OPERATIONS FOR HYPOSPADIAS

Formation of a Balanitic Urethra in Penoglandular Hypospadias.—Oval areas are denuded upon each side of the under aspect of the glans penis (Fig. 4992). These raw surfaces are brought together by suture, over a catheter, which is used as a form over which to work in the region of the glans (Fig. 4993) _ and, if used as a temporary bladder drain, is carried on backward along the urethra into the bladder. At a subsequent period the penoglandular orifice of the urethra is closed by freshening its margins and suturing these into contact.

Operation for Balanitic Hypospadias by Triple Penobalanitic Flaps.—This method is chiefly applicable to persons whose organs are large enough,



Fig. 4992.—Formation of a Balanitic Urethra in Penoglandular Hypospadias _ I; _ Denudation of the opposite areas upon each side of the under surface of the glans.

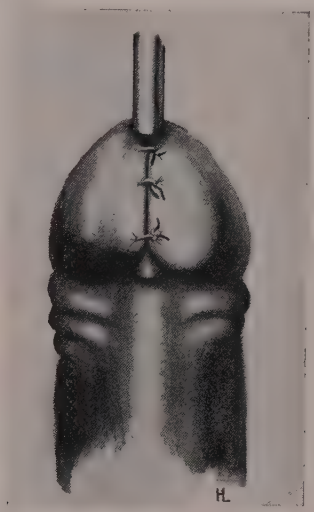
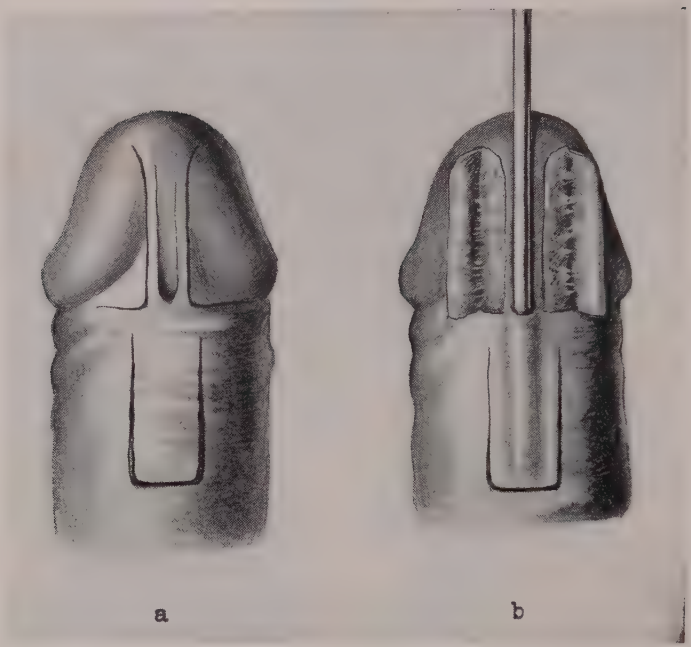


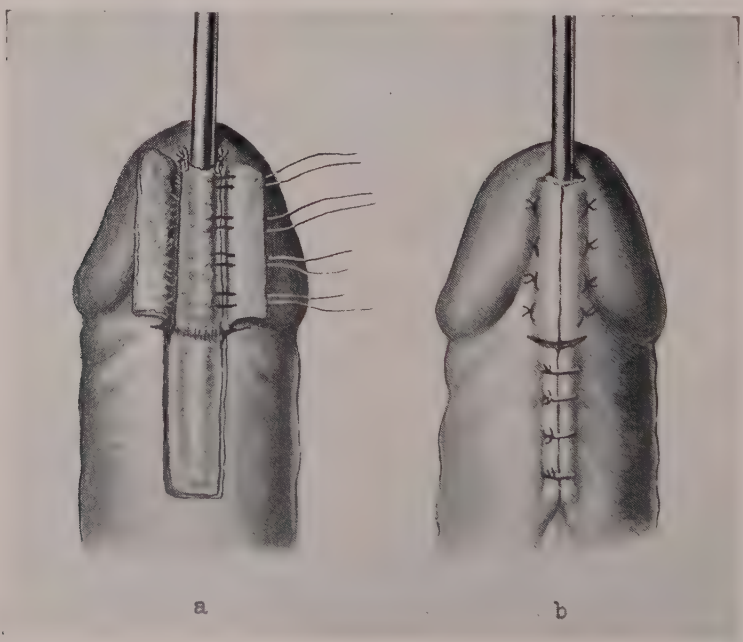
Fig. 4993.—The Same _ II; _ The two denuded areas are sutured over the catheter. The penoglandular gap in the urethra is to be subsequently closed.

by age, to furnish the necessary tissue. A small rectangular flap is raised from the body of the penis, proximal to the defect, so that it will hinge toward the glans when inverted, with skin surface downward, to form the floor of the new urethra. Its base is on a level with the hypospadiac opening (Fig. 4994, **a**). Two small lateral flaps are raised from the under surface of the glans on each side of the hypospadiac groove (Fig. 4995, **b**). The rectangular flap from the penis is turned forward and over the catheter which has been placed in position, sutured into the grooves at the bases of the two balanitic flaps _ after which the two flaps from the glans are sutured together over the raw surface of the median flap (Fig. 4996, **a**). The defect left by the rectangular flap is closed by suture (Fig. 4997, **b**).

Duplay's Operation for Penoglandular Hypospadias.—The procedure is especially indicated in hypospadias situated just posterior to the glans penis, and in which the under surface of the glans is grooved in the form of a median gutter. The technical procedure will differ somewhat, according to



Figs. 4994 and 4995.—Operation for Balanitic Hypospadias by Triple Penobalanitic Flaps: – a, Outlining the median flap from the penis, and the two lateral flaps from the glans; – b, the median flap is about to be inverted to form the floor of the new balanitic urethra, and to be sutured, on each side, into the angle made by raising the corresponding balanitic flap.



Figs. 4996 and 4997.—The Same – III and IV: – a, The median flap has been turned upward and sutured into position; – b, the lateral flaps have been sutured over the underlying flap – raw surfaces to raw surfaces – and the bed of the median flap has been closed by suture.

the exact position of the hypospadiac opening, and especially as to the depth or shallowness of the hypospadiac furrow. The field for the most ideal application of this technic is where the glans of the penis alone must be cut – as, also, is the procedure simpler when the involvement is of that structure. In the series of accompanying illustrations the involvement is of the penis just

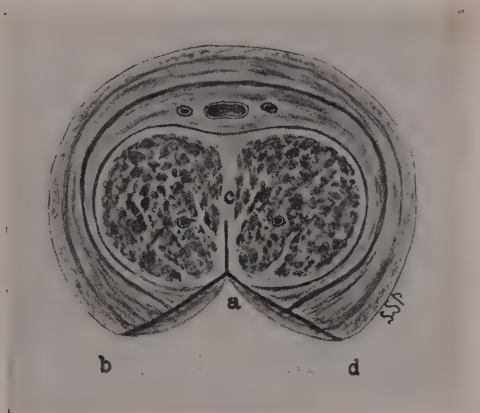


Fig. 4998.—DUPLAY'S OPERATION FOR HYPOSPADIAS – I; – The body of the penis is split, between the two corpora cavernosa, **ac**, after which the margins of the posterior aspect of the penis are denuded along the lines **ab** and **ad**.

posterior to the glans, involving the distal ends of the corpora cavernosa (of which the pictures are cross-sections) as well as the glans. In the simplest cases, where the furrow is deep and well marked, only the lateral aspects of the furrow need be freshened and sutured over the catheter placed in position as a form over which to suture. The denudations, then, are simply those



Fig. 4999.—The Same – II; – A rubber catheter is buried in the wound, and the penis closed over it by buried and superficial sutures.

shown in Fig. 4998, from **a** to **b** and from **a** to **d**. When, however, sufficient depth for the making of the new urethra is not thus securable, a median cut, from **a** to **c**, may be made. Following the simple denudation or where the median incision is used as well, the adjacent raw surfaces are sutured together over the catheter (Fig. 4999). In still other cases, owing to the conformation

of the parts and the need for making a deeper urethral canal, resort may be had _ after the paring of the lateral aspects of the furrow _ to two incisions carried obliquely into the adjacent corpora cavernosa (Fig. 5000) _ or, as more usually applies, into the glans penis. The catheter, in the act of suturing the sides together over it, depresses the median section of tissue _ thereby securing sufficient depth for the new urethra.

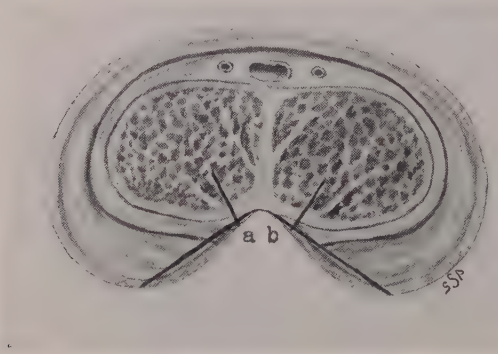
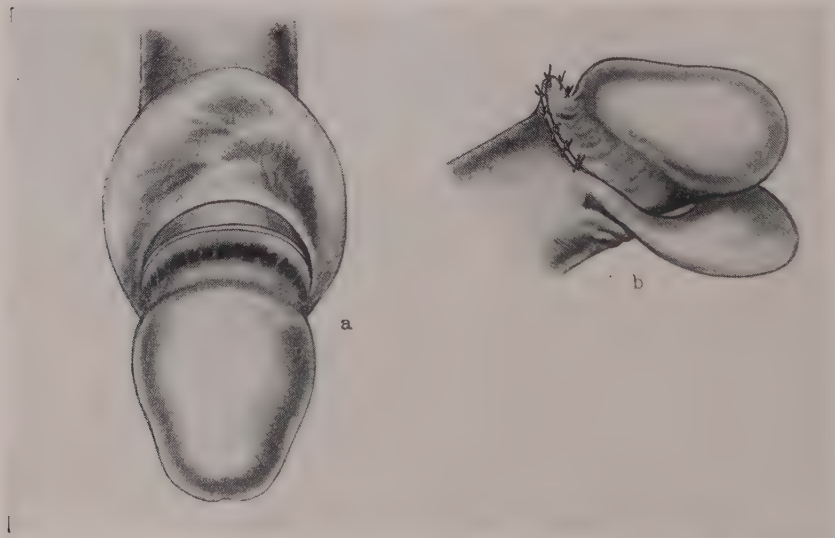


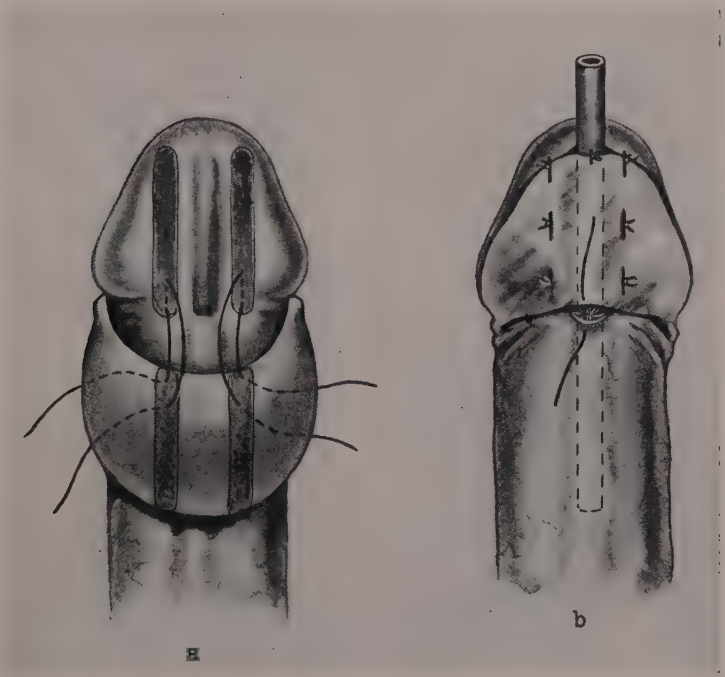
Fig. 5000.—The Same _ III; _ Where there is absence of sufficient tissue to bring around the catheter, the glans or body may be cut into laterally, at **a** and **b**, after the denudation.

Operation for Balanitic Hypospadias by Utilizing the Redundant Prepuce (Burghard).—A redundance of prepuce is usually present in these cases. If this redundancy be upon the inferior aspect of the glans, it is already in position for utilization. If it be upon the superior aspect of the glans it is buttonholed transversely (Fig. 5001) _ the head of the penis is drawn



Figs. 5001 and 5002.—Operation for Balanitic Hypospadias by Utilizing the Redundant Prepuce _ Burghard _ I and II: _ **a**, Buttonholing the redundant prepuce to bring it below the glans penis; _ **b**, the head of the penis has been brought through the slit in the prepuce, so that the hood of prepuce now hangs below the glans. The dorsal section of the prepuce has been sutured.

through the opening thus made, so that the redundancy now lies below the glans. The portion of the raw margin of the transfixed prepuce left above the glans is sutured (Fig. 5002). The penis is then thrown upward, upon the abdominal wall, so as to expose its under surface _ and two prolonged areas of denudation made _ extending along each side of the hypospadiac furrow upon the glans, and then continued, in a straight line, along the *skin* aspect of the displaced urethra (which is *now* nearer to the glans _ Fig. 5003). These denudations are made with fine curved scissors while the parts are steadied with forceps _ and the denuded areas should be accurately calculated so as to exactly coincide when sutured. All of the sutures are placed before any are tied in the manner illustrated _ either by ordinary curved needle or,



Figs. 5003 and 5004.—III and IV: _ a, The two parallel lines of denudation, upon prepuce and glans, are seen _ and the placing of the sutures; _ b, the prepuce has been sutured down, over the catheter, upon the glans, forming the floor of the new urethra. The slit margin of the urethra is being sutured to the lower lip of the hypospadiac opening.

better, by Reverdin needle. The end of a catheter is laid along the furrow and passed a short distance into the urethra _ and then the redundant prepuce, which is to form the floor of the new urethra, is brought up against the furrow, which is occupied by the catheter, and which is going to form the roof of the urethra. The sutures are then tied _ so that the result is as shown in Fig. 5004. All that now remains is to unite the slit margin of the prepuce to the freshened lower lip of the hypospadiac opening. To accomplish this the lower lip of the abnormally placed urethral orifice is tensed with fine forceps and freshened with curved scissors, thus separating the mucous from the skin aspect of this orifice. The mucous margin of the slit portion of the displaced prepuce (whose mucous aspect has been displaced to the outer side by shifting the prepuce) is now sutured to the skin asectp of the margin of the

split prepuce, and the skin aspect of the abnormal meatus to the mucous aspect of the margin of the split prepuce – this being the natural relationship of the now transposed parts. Fine catgut is used in this last suturing.

Beck's Operation for Penobalanitic Hypospadias.—The chief field of usefulness of this technic is in those cases where the hypospadiac opening is near the glans penis. The abnormal opening of the urethra is surrounded by an encircling incision – the upper aspect of which is continued outward, on both sides, in the postcoronal sulcus – and the lower aspect of which is continued downward as a median incision upon the under surface of the penis (Fig. 5005).

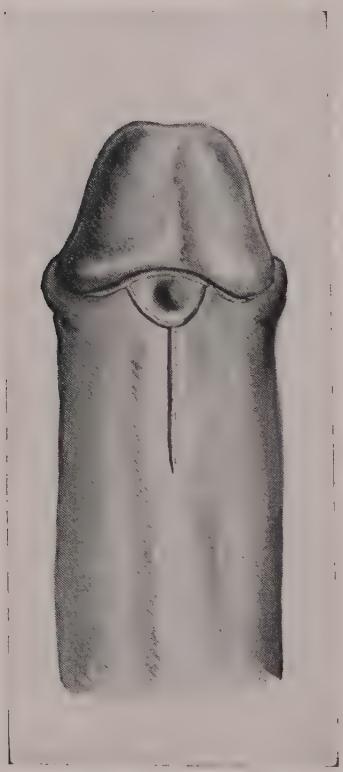


Fig. 5005.—Beck's Operation for Hypospadias – I; – Lines of incision around the congenital meatus, between the glans and the body of the penis, and down the body of the penis, in the middle line.

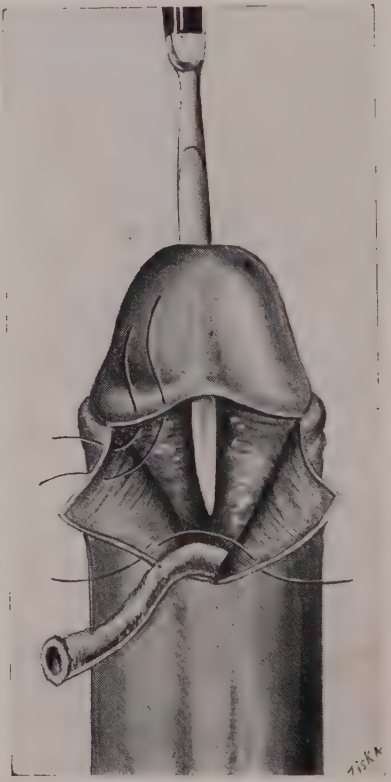


Fig. 5006.—The Same – II; – Tunneling the glans in the direction of the normal course of the urethra – after freeing the urethra and its abnormal meatus, by dissecting back two angular flaps. Stitches are placed, to be subsequently tied.

Working in the connective-tissue plane, two triangular flaps are raised, to either side, and turned outward. This freeing of the parts enables the urethra to be mobilized down to the lowermost limits of the flaps (Fig. 5006). A straight, narrow-bladed bistoury is now thrust through the substance of the glans penis either from behind, forward, or from before backward – in the direction and position normally occupied by the urethra. Through the tunnel thus made the closed blades of a pair of slender forceps is passed, from the free end of the glans backward, and, grasping the freed end of the urethra, draws it forward through the artificially made passage – where its distal end is anchored by several sutures to the margins of the opening made in the face

of the glans (Fig. 5007). Instead of tunneling the glans penis in the manner mentioned the groove for the mobilized urethra may be made by medially incising the posterior aspect of the glans in continuity with the median incision made earlier in the operation – and the urethra be drawn outward and sunken into this furrow, and its end sutured into the margins of the cut upon the face of the glans (Fig. 5008). Finally, the triangular flaps are turned back into position and sutured – and, in the case of splitting the glans medially, these split margins are also sutured.

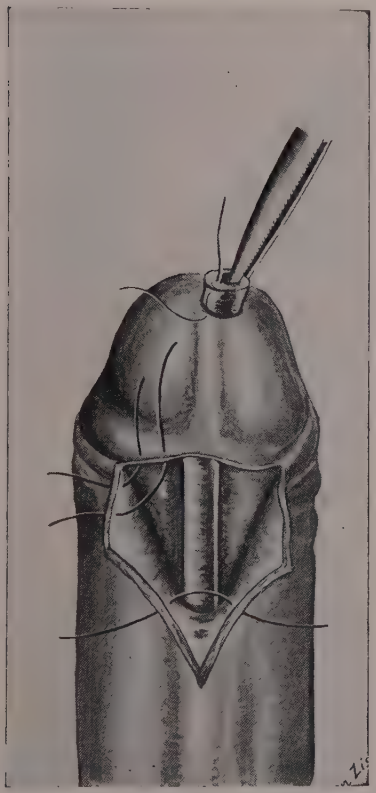


Fig. 5007.—The Same – III; – The urethra has been drawn through the glans by means of forceps – its meatal end is being anchored to the mucosa of the glans.

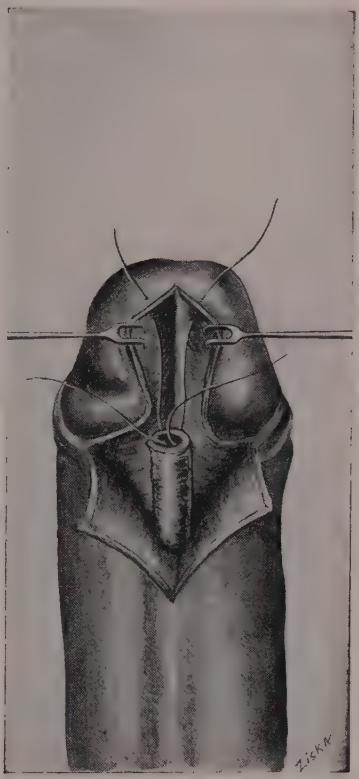


Fig. 5008.—The Same – IV; – As an alternate technic, at this stage, a bed may be made for the drawn-out urethra by splitting the ventral aspect of the glans – after which the urethra is anchored upon the surface of the glans – and the split glans and body flaps closed about it.

Landerer and Bidder's Operation for Hypospadias by Covering From the Scrotum.—This technic is an application of the principle of Rosenberger applied in the corresponding operation for epispadias (q. v.). The margins of the penile hypospadiac opening are freshened, and an oval area of some width immediately surrounding it is denuded. A corresponding oval upon the scrotum is also denuded (Fig. 5009). In calculating these ovals one must know, by trial approximation, that they will fall into accurate and easy apposition. When the surfaces are in readiness – and provision has been made for bladder drainage – the surfaces are brought into contact and sutured together by stitches which are so applied from the periphery of the ovals as to take a

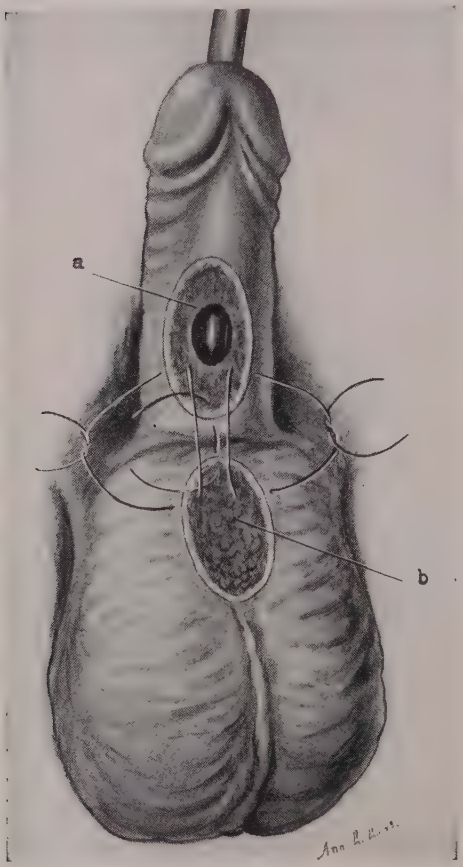


Fig. 5009.—Landerer and Bidder's Operation for Hypospadias – I: – a, An oval area surrounding the hypospadias is freshened; – b, a corresponding solid oval area is denuded upon the scrotum. These denuded areas are then sutured together throughout. Only three of the sutures are here shown. The denudation and suturing may include the penoscrotal junction.



Fig. 5010.—The Same – II; – View of the preceding steps seen in cross-section.

good hold upon a fair width of raw tissue, that the union will be as substantial as possible (Fig. 5010). Subsequently, when union has been accomplished, the structures are cut apart from each other at the expense of the scrotal tissue. Following the cutting apart, if the margins of the raw surfaces cannot be mobilized and sutured together _ or if they can be done so in part _ the remaining raw surface is grafted, or allowed to granulate.

Beck's Operation for Penoscrotal Hypospadias.—The repair is here made by reversed lateral flaps from the penis, covered by a twisted flap from the scrotum. Sufficiently to the outer side of and parallel with each outer border of the hypospadiac groove, to form two long lateral flaps to cover over



Fig. 5011.—Beck's Operation for Penoscrotal Hypospadias _ I; _ Two long, narrow, penile flaps a and b, are raised on either side of the groove usually occupied by the urethra.

the defect, a vertical incision is made _ extending from just behind the penoscrotal opening of the urethra to the end of the glans penis (Fig. 5011). These two long narrow flaps are mobilized in their connective-tissue plane _ and are reversed, with skin inward, toward the median line, and their margins sutured together over a catheter, with their raw surfaces outward (Fig. 5012). In order to cover this raw surface formed by both the reversed flaps and the beds from which they were raised a long, median scrotal flap is raised, calculated of sufficient length and width to cover over these surfaces, without tension. It is freed everywhere except at its pedicle, which is toward the penis. The incision on the side toward which the flap is to be swung by twisting is made

somewhat longer (extended nearer the base of the penis) than is the incision of the opposite side – as shown in the picture last quoted. When all is in readiness, this long scrotal flap is twisted upon its pedicle and carried upward – laid upon the raw surfaces of the penis – and its margins everywhere sutured to them, as seen in Fig. 5013. Finally, the raw scrotal bed is covered in by suturing the margins together.

Nové-Josserand-Rochet Operation for Penile Hypospadias.—In this technic a urethral tube is constructed around a catheter, from tissue taken

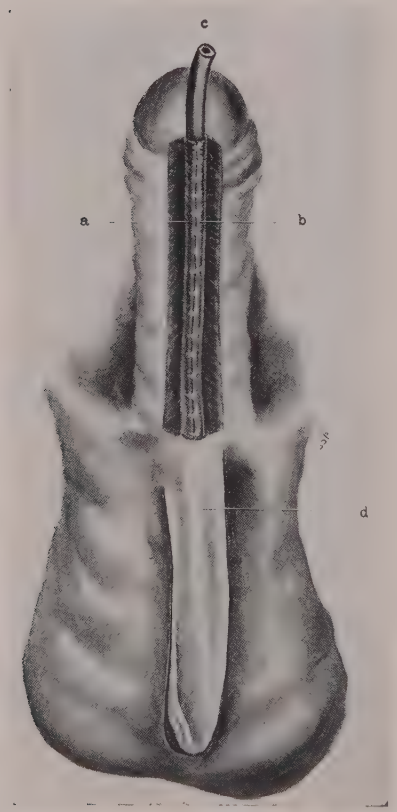


Fig. 5012.—The Same – II; – The penile flaps, **a** and **b**, are inverted inward and sutured over a rubber tube, **c**, so that the raw surfaces of the new tube, as well as the beds from which they are raised, look outward. A scrotal flap, **d**, corresponding with the penile raw surfaces, is being raised.

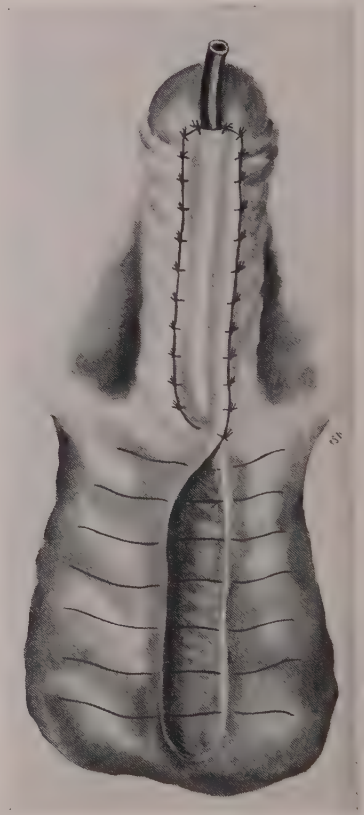


Fig. 5013.—The Same – III; – The scrotal flap is displaced upward and sutured into the penile raw surfaces. The scrotal wound, left by the scrotal flap, is being sutured.

from the scrotum, and this tube, upon the catheter form, is conducted through a canal tunneled in the site normally occupied by the urethra. A long, rectangular flap is raised from the scrotal covering, the hair bulbs of which have been previously destroyed. The outlining for this long flap begins just anterior to the penoscrotal hypospadiac opening. Its length is as long as will be required to reach to the position of the normal meatus. Its width will be calculated to easily surround the contained catheter and to form a roomy new urethra. This long flap is raised everywhere except just at the hypospadiac

opening (Fig. 5014). It is then rolled around the catheter, very much as a cigarette is rolled – after which the lateral margins of the flap are sutured around the catheter. At this stage – or earlier in the operation – a canal is tunneled under the skin of the inferior aspect of the penis from the hypospadiac opening to the position for the opening of the meatus in the glans penis. The canal must usually be cut through the glans, but in the rest of its course a pair of long, straight slender, rather sharp-ended forceps may be used,

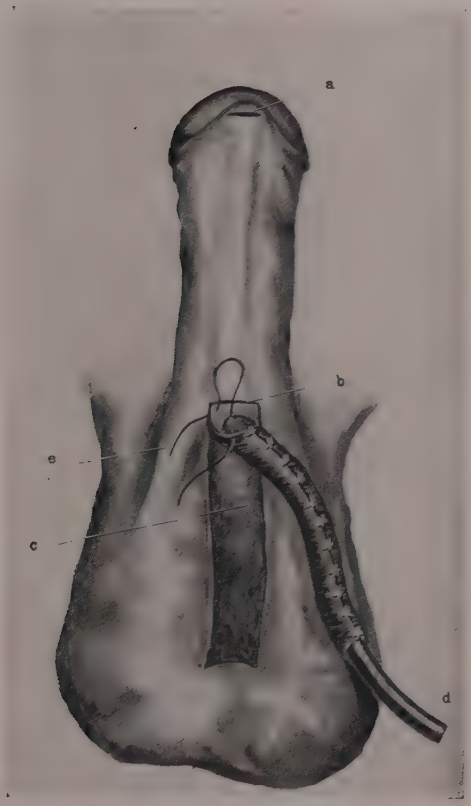


Fig. 5014.—Nové-Josserand-Rochet Operation for Hypospadias – I; – **a**, Transverse incision immediately behind the glans; – **b**, transverse incision just anterior to the hypospadias. The connective tissue is tunneled between **a** and **b**. A flap of scrotal skin and fascia of sufficient width and length (of which **c** represents the bed) is raised and sutured around a rubber tube, **d**; **e**, suture closing the hypospadiac opening around the catheter.

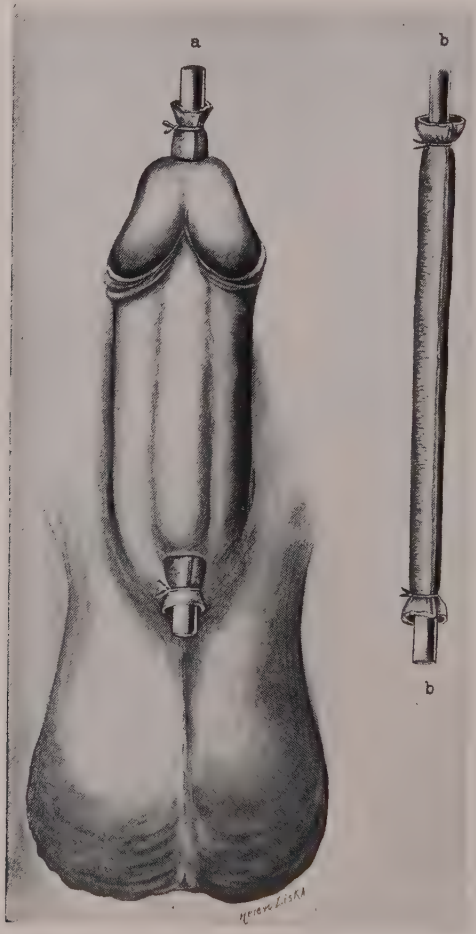


Fig. 5015.—The Same – II; – The catheter, surrounded by inverted penoscrotal skin, is drawn through the new channel and anchored at the new meatus. The penoscrotal wound is closed by suture.

whose blades, after tunneling their way through, are separated sufficiently in withdrawal to open up a sufficiently roomy way in the connective-tissue plane for the accommodation of the catheter and surrounding tissue. The long slender forceps are then introduced through the channel from the new meatus – seize the catheter and surrounding soft parts, and draw them forward through the canal – so that they now occupy the position shown in Fig. 5015. The free margin of the new urethra is sutured to the margin of the

new meatus. The raw bed, left on the face of the scrotum, is closed by transversely running sutures.

The original Nové-Josserand operation differed from the technic just described _ in that a dermo-epidermic graft was taken from some hair free region, such as the inner side of the arm or thigh _ fastened around a catheter _ and then drawn into position between the hypospadiac opening and the new meatus, through the previously tunneled channel. This technic is shown in Figs. 5016 and 5017.



Figs. 5016 and 5017.—Penoscrotal Hypospadias _ Urethroplasty by Dermo-epidermic Graft: _ a, a, The penis tunneled from just in front of the hypospadiac opening (hidden by graft) to the glans _ with the graft drawn into position. b, Dermo-epidermic graft, raw surface outward, folded around a rubber sound or catheter.

Mayo's Operation for Penile Hypospadias.—A new urethral tube is here made from the skin of the dorsum of the penis. In advance of the major operation bladder drainage is provided for through a perineal fistula. Putting the foreskin upon tension, two parallel axial incisions, about 2.5 cm. (1 inch) apart, are made from the free fold of the prepuce backward to its union with the corona _ and thence, still backward, over the dorsum of the

penis, for a distance toward the base of the penis sufficiently far to furnish a new urethral tube of the required length where they are connected by a transverse cut. These cuts pass through the skin into the connective-tissue plane _ and the dermo-epidermic flap thus outlined is raised, and so rolled as to bring the outer margins together by interrupted sutures, with the skin upon the inner side and the raw surface without _ thus constituting a skin lined new urethra (Fig. 5018). With a long, narrow-bladded straight bistoury a channel is tunneled from the normal position of the meatus to the hypo-



Fig. 5018.—Mayo Operation for Hypospadias _ I; _ A rectangular piece of skin and fascia extending from the free border of the prepuce backward is raised from the dorsum of the penis. This piece of skin and fascia is sutured in tubular form. The margins of the bed from which it is raised are sutured together. A long narrow bistoury tunnels a new urethral site from the normal position of the meatus upon the glans to the hypospadiac opening on the under surface of the penis.



Fig. 5019.—The Same _ II; _ Forceps are introduced along the new urethral site from behind forward _ the free end of the new tube is seized and drawn over the glans penis and through the new canal _ bringing raw surface to raw surface. The dorsal wound of the penis is closed by suture.

spadiac opening, and sufficiently roomy to accommodate the new urethra. A pair of slender forceps is carried through the tunneled channel, from the hypospadiac opening, to the new meatus, and the sutured tube seized and drawn backward to the hypospadiac opening (Fig. 5019) _ to the margins of which, previously freshened and mobilized, it is sutured, invaginating it at the same time and closing the skin opening. The boundaries of the bed from which the dorsal flap was raised are brought together by sutures as far as can be done at this stage. In about ten days the pedicle of the tubal flap is cut just above the meatus _ after which the cut margins of the tube are stitched into the opening in the glans. Following the division of the flap the parts are repaired as indicated.

Bucknall's Operation for Penoscrotal Hypospadias.—This procedure

is considered by Burghard, whose summary of it is here given, as the most satisfactory of the operations for this type of hypospadias.

Stage A: Beginning with the hypospadiac opening as the point from which the incisions above and below are to be of equal length, or possibly a little longer upon the scrotal aspect, two straight, parallel axial cuts are made — from the position at which the meatus is to be in the glans to as great a distance below the hypospadiac opening, or a little greater, than the incisions extend above it. The incisions are distant from each other sufficiently to form an easy covering for the new urethra. The upper and lower ends of these two long incisions upon the under surface of the penis and the face of the scrotum have added to them transverse incision of about 6 mm. ($\frac{1}{4}$ inch) (Fig. 5020). Two long lateral flaps are now mobilized, each the length of the long incisions, and the width of the added transverse incisions — and are turned outward. Of the strip of intact tissue between the raw beds the penile portion will form the roof, and the scrotal portion, the floor of the new urethra. A soft Jaques catheter, No. 6, whose end has been cut obliquely, is carried for 1.3 cm. ($\frac{1}{2}$ inch) into the hypospadiac opening, enlarging the opening by incision if need be. Applying the outstanding portion of the catheter to the sound strip of tissue along the face of the scrotum, the penis is brought into contact with the scrotum, so that the sound strip of tissue upon its under surface is applied to the catheter immediately over the sound strip upon the scrotum — the appearance of the parts being broadened flange-like, by the



Fig. 5020.—Bucknall's Operation for Penoscrotal Hypospadias — I; — Outlining the penoscrotal incisions and raising the penoscrotal lateral flaps. The site of the hypospadiac opening is seen.



Fig. 5021.—The Same — II; — The penis has been hinged downward upon the scrotum — bringing into contact the previously denuded raw surfaces of the penoscrotal flaps as two broad flanges. The margins may be sutured directly or over rubber tubing.

outward projection of the lateral flaps. The suturing of these lateral flaps must be done with extreme care — so that the entire width of the flaps will be brought into contact — from the extreme outer margins to the inner limits of the raw surface of each flap (and these lateral flaps must have been raised of equal width throughout). The suturing is done with very small, curved needles, carrying the finest horsehair. The appearance of the sutured parts is as shown in Fig. 5021. The sutures are tied over two pieces of fine rubber tubing, one above and one below the united flaps. Four or five interrupted sutures are used on each side.

The margins of the balanitic groove can be freshened and sutured to the freshened area of the scrotum — or this detail may be performed as a later, independent procedure.

The catheter is held in place by a suture and drains into a bottle. No dressing is employed — though the site of operation is protected from the friction of bedclothes. The alternate stitches are removed on the fifth day, and the rest on the seventh or eighth day, if union be satisfactory. The catheter remains *in situ* for a week if not contraindicated.

Stage B: An incision through the scrotal skin, surrounding the site of union of the penis to the scrotum, is carried out. A wide calculation should be here made, so that enough tissue will be secured to fold around the penis — and which the scrotum can well afford. In dissecting the adherent penis from the scrotum great care is to be exercised not to buttonhole the tissues, and aid in this direction is secured by having placed a soft catheter in the new urethra. When the penis is freed from the scrotum, it is raised, and the margins of the scrotal skin, raised with it, are brought around the body of the penis and united by sutures. The margins of the scrotal gap are also sutured together. The sutures applied in the second stage are removed at the end of a week. No catheter and no dressing are employed.

An application of this technic to perineoscrotal hypospadias is more difficult.

Burghard has suggested that if it be proved that the growth of hair upon the scrotal skin be an objection, that this be remedied by preliminarily preparing the site from which the scrotal tissue is to be removed by grafting non-hairy skin upon it.

CHAPTER LXXVIII

OPERATIONS UPON THE PENIS

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The freeing of preputial adhesions, p. 748; – Incision of periurethral abscess, p. 749; – Incision of the prepuce for exposure of the head of the penis, p. 750; – Incision of the prepuce for phimosis, p. 751; – Operation for phimosis by axial incision, followed by transverse suturing (Daggett's technic), p. 752; – Operation for paraphimosis, p. 753; – Operation for shortened frenum of the penis, p. 755; – Operation for downward curvature of the penis caused by median fibrous bands, p. 755; – Partial excision of the urethra for tumor involvement followed by advancement of the urethra (Cathelin's operation), p. 757; – Plastic operation for recovering with skin the entirely denuded penis (Reich's operation), p. 757.

Operation of circumcision or partial excision of the prepuce for phimosis (various methods), p. 760; – Circumcision, with complete excision of the mucosa, p. 774.

Amputation of the penis, in general, p. 775; – Partial amputation of the penis, p. 776; – Complete amputation, or excision of the penis, through the temporarily split scrotum (Pearce Gould's technic), p. 783; – Complete amputation, or excision of the penis, by combined pubo-inguinal and perineal incisions (Taylor's technic), p. 787.

Total radical excision of the penis, testes, and scrotum, along with the inguinal lymphatics, p. 790.

SURGICAL ANATOMY OF THE PENIS

Description.—Consists of glans, body, and root, together with skin, connecting tissues, vessels, and nerves. Body is composed of two corpora cavernosa and the corpus spongiosum, the latter containing the urethra.

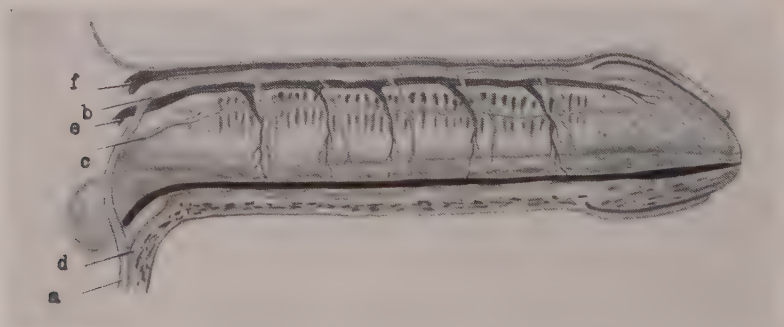


Fig. 5022.—Vessels of the Penis, Sectional View: – **a,** Internal pudic artery; – **b,** dorsal artery; – **c,** cavernous branch of dorsal artery; – **d,** bulbo-urethral artery; – **e,** deep dorsal vein; – **f,** superficial dorsal vein.

Corpora Cavernosa.—Connected, side by side, in the median line, for their anterior three-fourths – an imperfect fibrous septum intervening. Separated, posteriorly, to form the crura or roots. The crura are attached by their blunt, fibrous, posterior ends to the antero-internal aspects of the two rami of the pubes and ischia, above the tuberosities. The anterior ends of the

cavernosa are received into the fossa formed by the base of the glans penis or head. The superior median groove of the corpora cavernosa lodges the dorsal vein of the penis. The inferior median groove lodges the corpus spongiosum.

Corpus Spongiosum.—Encloses the urethra, which passes into the bulb nearer its superior aspect. It is received into the inferior median groove of the



Fig. 5023.—Transverse Section Made Through the Base of the Glans Penis; – The arteries of the corpora cavernosa are seen.

corpora cavernosa. It ends anteriorly in the glans penis or head of the organ. It ends, posteriorly, in the bulb of the corpus spongiosum – between the diverging crura of the corpora cavernosa, and between the deep layer of the superficial fascia and the superficial layer of the deep fascia – being covered by a fibrous process from the anterior layer of the deep perineal fascia and surrounded by the accelerator urinæ muscle.



Fig. 5024.—Transverse Section Made Through the Body of the Penis: – a, Dorsal artery; – b, superficial dorsal vein; – c, deep dorsal vein; – d, dorsal nerve; – e, artery of corpus cavernosum; – f, deep veins of the penis; – g, bulbo-urethral artery.

Suspensory Ligament of the Penis.—A fibrous band passing from the front of the symphysis pubis to the adjacent portion of the penis, merging with its fascial sheath.

Muscles of Penis.—Erector penis; accelerator urinæ; compressor urethræ; transversus perinæi.

Arteries.—(*a*) Of the corpora cavernosa: – arteries of the corpora cavernosa, dorsal arteries of the penis. All from internal pudic. (*b*) Of the corpus spongiosum: – artery of the bulb, from internal pudic.

Veins.—Some of the veins empty into the dorsal vein, which ends in the prostatic plexus. Other veins empty directly into the prostatic plexus, pudic

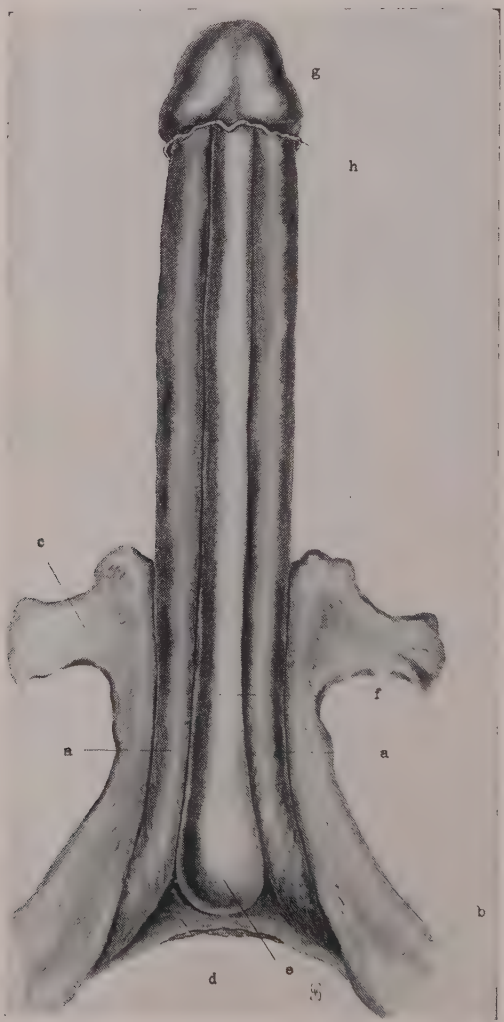


Fig. 5025.—Attachment of the Crura of the Penis (Here Shown Erect) to the Antero-internal Aspect of the Rami of Pubis and Ischium: – **a, a,** Crura penis; – **b,** ischium; – **c,** pubis; – **d,** anterior layer of the triangular ligament; – **e,** bulb of urethra; – **f,** corpus spongiosum; – **g,** glans penis; – **h,** severed prepuce. (Redrawn from Spalteholz, Sobotta and McMurrich, and Deaver.)

plexus, pudic veins, and obturator veins. Others empty into the cutaneous veins of the penis and scrotum.

Lymphatics.—The superficial empty into the inguinal glands. The deep empty into the pelvic glands.

Nerves.—From the dorsal and superficial perineal branches of the pudic and from the hypogastric plexus of the sympathetic.

The root of the penis and the proximal portion of the body lie underneath the scrotum and beneath the superficial structures of the perineum – and are firmly attached to the triangular ligament, to the pubic bones, and the symphysis pubis – these parts constituting the fixed portion of the organ – in contradistinction to the free portion.

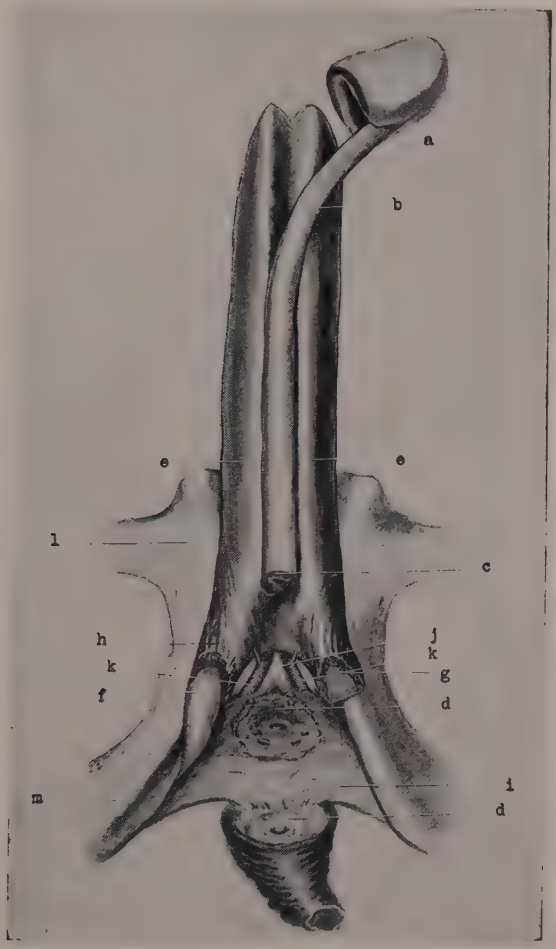


Fig. 5026.—Relations of the Deeper Structures of the Penis: – a, Glans penis; – b, corpus spongiosum; – c, divided portion of corpus spongiosum; – d, d, divided bulb; – e, e, corpora cavernosa; – f, right crus penis; – g, divided left crus penis and ischiocavernous muscle; – h, ischiocavernous muscle of right crus divided near insertion; – i, superficial layer of triangular ligament; – j, dorsal vein of penis; – m, ischium. (Modified from Spalteholz.)

The two corpora cavernosa and the corpus spongiosum are made up of masses of erectile tissue, contained within three more or less cylindric, fibrous compartments. Besides the fact that each mass of erectile tissue lies within its own fibrous envelope, and that these are more or less closely united, all three are surrounded by a second fibrous envelopment, termed Buck's fascia, which is the fibrous bond between the penis and the suspensory ligament and the symphysis pubis – and this, in turn, is surrounded by the

dartos, lying beneath the skin and continuous with the dartos of the scrotum.



Fig. 5027.—Sectional View of the Male Genito-urinary Organs and Surrounding Structures: – a, Ureter; – b, bladder; – c, vesicula seminalis; – d, vas deferens; – e, prostate gland; – g, membranous urethra; – m, bulb of corpus spongiosum covered by accelerator urinæ muscle; – h, corpus spongiosum; – i, corpus cavernosum; – j, Cowper's gland between the layers of the triangular ligament; – k, levator ani; – l, non-peritoneal surface of the rectum; –o, vesical reflection of the peritoneum; – p, rectal reflection of the peritoneum. (Redrawn from Gray, Spalteholz, and Deaver.)

THE FREEING OF PREPUTIAL ADHESIONS

While the presence of preputial adhesions usually calls for circumcision, or incision, sometimes the indications may be sufficiently met by freeing the adhesions without resorting to either circumcision (which amounts to a partial excision of the prepuce), or even to an incision of the prepuce – provided the preputial orifice be sufficiently patulous to admit of being drawn backward over the head of the penis after the adhesions are broken down.

Occasionally these adhesions may be overcome by simple backward traction of the prepuce toward the corona glandis – but this is only exceptionally the case. In the majority of instances the adhesions must be mechanically broken down by instrumental means.

The instruments usually employed for this purpose are either an ordinary probe or a grooved director. These are manipulated between the preputial mucosa and the glandular mucosa after being introduced through the orifice of the foreskin, in the manner shown in Fig. 5028. They are passed from side to side, and backward, as progress is made – and swept laterally completely around the glans from meatus to corona – and always hugging the convex surface of the glans.

In those cases in which no satisfactory headway can be made by this technic nothing remains but either to incise or partially excise the redundant

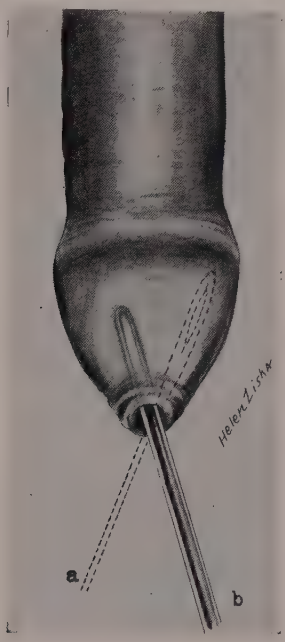


Fig. 5028.—Freeing Preputial Adhesions: _ a, By probe; _ b, by grooved director.

prepuce. Even when this is done the denser types of adhesions will have to be peeled apart as described and pictured under Circumcision.

INCISION OF PERIURETHRAL ABSCESS

Periurethral suppuration is usually the result of infection from the urethra as a source _ and generally by way of the urethral glandular structures _

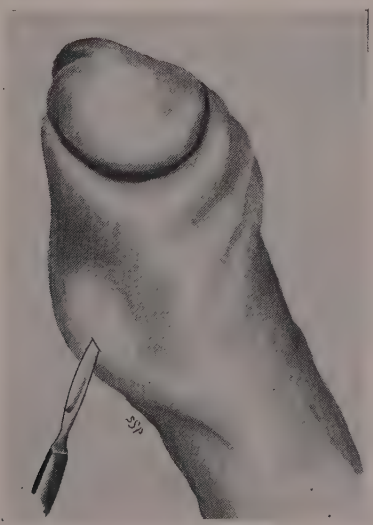


Fig. 5029.—Incision of Peri-urethral Abscess.

bacteria entering the glands from the mucous surface, their mouths becoming blocked, followed by extra-urethral invasion through rupture of the gland sacs into the connective-tissue planes.

Abscesses here, as elsewhere, should be incised – the practical features of the technic being twofold – that the incision of skin and overlying structures should be made axially (Fig. 5029) – and that it should be made carefully and only just into the pus cavity, which may be then enlarged upon a grooved director – in order that no risk may be run of incising into the urethra – which would be likely to result in a urethral fistula.

The pus sac is packed and allowed to granulate.

INCISION OF THE PREPUCE FOR THE EXPOSURE OF THE HEAD OF THE PENIS

Even though a prepuce may not be phimosed, or abnormally constricted at its orifice, it often happens in pathologic processes, especially such as may oc-



Fig. 5030.—Dorsal Incision of the Prepuce – to expose the glans and mucosa.



Fig. 5031.—Bilateral Incisions to Expose the Glans and Mucosa.

cur in conjunction with venereal involvements of the penis, that the prepuce becomes so swollen and infiltrated that it cannot be drawn back over the head of the penis, over which, at other times, it may have readily passed. In order to gain access to diseased conditions of the glans penis, or of the mucous lining of the prepuce, it may be necessary to resort to some method of surgical procedure. Circumcision, which might otherwise be indicated in the special case, may, because of the pathology present, be contraindicated – because of the likelihood of infection of the entire circular line of incision, and resulting failure of union. And as access to the parts is the major consideration, this may have to be sought in the simplest way possible.

The most usual method of procedure is to divide the prepuce in a single straight line, axially, in a position which will give most direct access to the supposed lesion – as suggested in Fig. 5030.

In unusual instances a single incision may not afford sufficient access – so

that, occasionally, two parallel incisions are made, usually a half circumference apart – and the resulting window flap turned back – as seen in Fig. 5031.

The manner of subsequently treating these incisions will depend upon circumstances. Rarely can they be at once sutured together, as the conditions for which they were originally made are apt to be reproduced. As a rule the parts are left wide open – and are not further dealt with until the conditions are well for which they were made – when some method of plastic repair is resorted to – or a modified form of circumcision performed.

INCISION OF THE PREPUCE FOR PHIMOSIS

Instances will arise in which the glans penis, embraced by a too tight prepuce, can be freed from the contracted envelopment, both for immediate and future needs, with entire satisfaction, by means of an axial, dorsal incision,

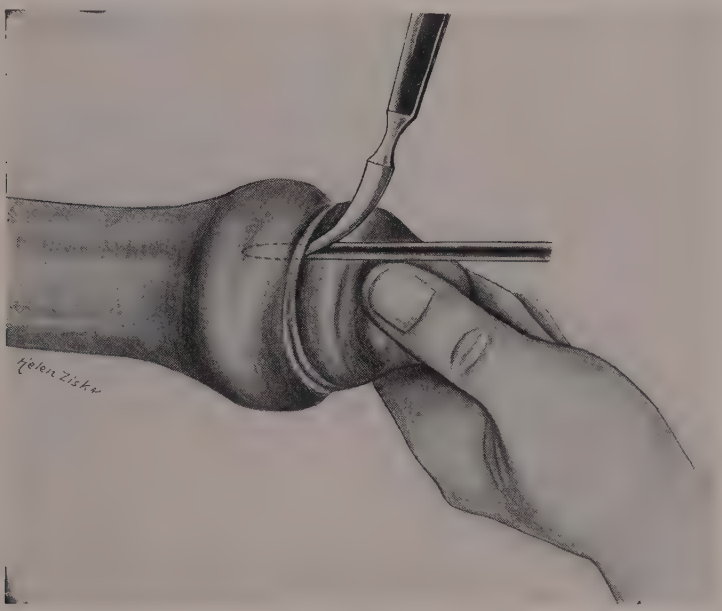


Fig. 5032.—Operation for Phimosis by Incision Upon a Grooved Director – 1; – A grooved director is passed beneath the constricting ring – upon which the band of constriction is divided from within outward (as here shown) – or from without inward.

the margins of which are then sutured – instead of having to resort to partial excision of the prepuce (circumcision).

It is usually possible to draw the foreskin back part of the way, but not as far as the corona. One of two methods is generally resorted to in order to divide as much of the constricted portion of the prepuce as may be necessary. Probably the best method is the introduction of one blade of a pair of Mayo scissors beneath the edge of the tightened band of prepuce, and cut upward, in the middorsal line, as far toward the base of the glans as needed to increase the orifice of the prepuce sufficiently for it to readily slip backward and forward over the glans. Another method of making the division is to slip a grooved director beneath the tightened margin, and, upon this, direct the blade of a bistoury – which then cuts its way from within outward, through a part of the way between the margin of the prepuce and the base of the glans – as seen in Fig. 5032.

In completing the operation the mucosa and skin are sutured together upon both limbs of what has now become a broad V, resulting from tension upon the middorsal straight incision (Fig. 5033).

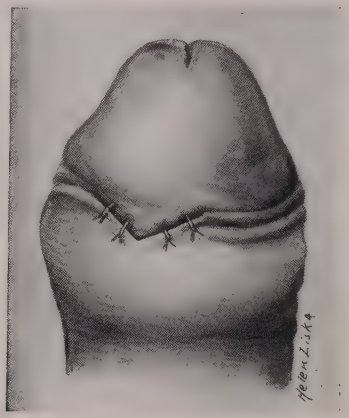


Fig. 5033.—The Same – II; – Following the straight incision through the constricting prepuce the previous constriction is relieved by the relaxation opening – the margins of which are sutured.

It will be seen that the effect is, in result, practically the same as follows circumcision – without as much traumatism.

OPERATION FOR PHIMOSIS BY AXIAL INCISION, FOLLOWED BY TRANSVERSE SUTURING

DAGGETT'S METHOD

The object of this procedure is to increase the orificial circumference of the prepuce by means of a comparatively simple technic, similar in principle

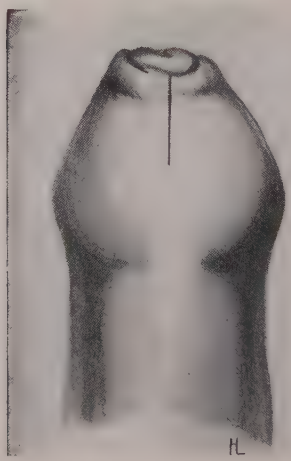


Fig. 5034.—Daggett's Operation for Contracted Prepuce – I; – Dorsal median incision of prepuce.

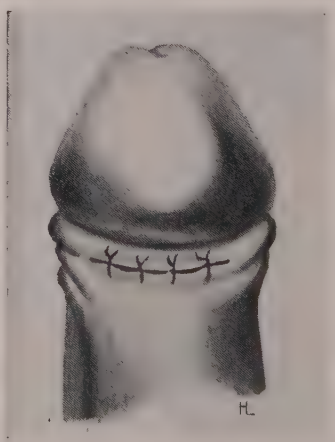


Fig. 5035.—The Same – II; – Transverse suturing of the dorsal incision.

to that of the Heineke-Mikulicz operation of pyloroplasty for contracted pylorus.

The incision is median, and may be placed upon either the dorsal or the ventral aspect of the prepuce _ usually the former. It must involve the free edge of the prepuce _ that is, both cutaneous and mucous aspects. The cut is most conveniently made with Mayo scissors. The length of the incision will determine the amount of increase in circumference of the resulting preputial orifice.

In adopting a dorsal incision the cut is placed as shown in Fig. 5034. The resulting widening of the orifice of the prepuce will enable the structure to be drawn backward over the corona _ where the median cut is transversely sutured as seen in Fig. 5035.

If, for any reason, it seems better to make a median ventral cut of the mucocutaneous margin, the cut is placed as shown in Fig. 5036 _ not extending backward far enough to involve the frenum. The resulting relaxed foreskin is then drawn backward over the glans, and the median cut is transversely sutured as seen in Fig. 5037.



Fig. 5036.—The Same _ III; _ Median axial incision over the frenum.

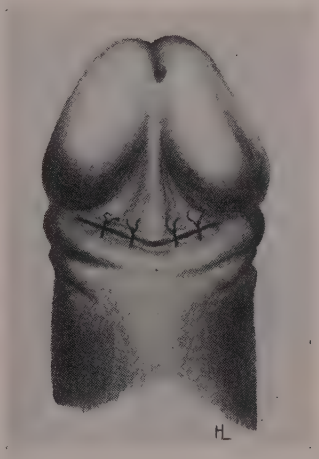


Fig. 5037.—The Same _ IV; _ Transverse suturing of the median axial incision over the frenum.

As in the procedure last described, the result of this operation, in effect, in cases in which it is applicable, is the same as that of a circumcision, with less traumatism.

OPERATIONS FOR PARAPHIMOSIS

In paraphimosis the constricted prepuce is held behind the glans penis by a circularly constricting band posterior to the corona. Sometimes by the simultaneous compression of the glans and the forward traction of the prepuce the constriction can be overcome, and the prepuce be brought forward over the head of the organ. At other times this may be impossible _ and some cutting operation be required _ which is usually in the form of an axial incision through the constricting band. All incisions should be made a little to one side of the median line to avoid cutting the dorsal vein of the penis.

The simplest manner of dividing the constriction _ in the cases where the conformation of the postcoronal folds will enable this to be done _ is to carry a curved, grooved director from behind beneath the special fold it is desired to divide _ not through the tissues _ and then to make a stab cut directly

down through the constricting band into the groove of the director, cutting from behind forward and outward _ as suggested in Fig. 5038.

Another method of cutting from without inward is to first make a small skin incision, posterior to the site of constriction, just to one side of the mid-

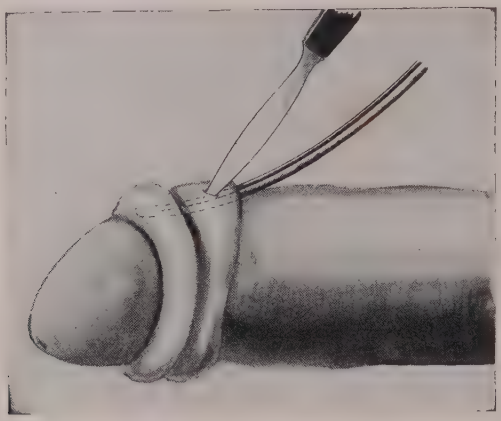


Fig. 5038.—Incising Constricting Paraphimosis _ by stabbing down and under, and cutting forward and outward upon a grooved director, which has been protruded ahead of it beneath, not through, the constricting fold or folds.

dorsal aspect of the penis _ and, through this, carry a grooved director, in the connective-tissue plane, beneath the band of constriction (Fig. 5039). Upon this the site of constriction is divided from without _ either in the same manner of stab incision as in the preceding technic _ or by deliberately cutting down upon and through the constriction upon the grooved director.

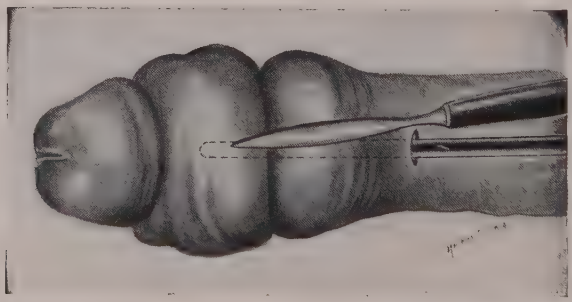


Fig. 5039.—Operation for Phimosis by Cutting from Without Inward; _ The size of the glans has been lessened by compression until the phimosis can be pushed behind the glans, and converted into a paraphimosis. A grooved director, introduced through a small incision proximal to the constriction, is passed beneath the constricting ring _ after which the constriction is relieved by cutting either from without inward (as here) _ or from within outward.

Still another method of procedure is to carry the grooved director beneath the constriction in the manner last described _ and then, upon the grooved director, to carry a long, straight bistoury _ with which the constriction is divided subcutaneously.

OPERATION FOR SHORTENED FRENUM OF THE PENIS

The tendency of an abnormally shortened frenum is to cause the head of the organ to be bent forward and downward during erection. This may be a congenital deformity or may be pathologic _ or may result from damage during circumcision.

A simple method of correcting this defect in average case is the principle of a transverse cut over the site of contracture (Fig. 5040) _ followed by approximation and suture of the lips of the wound in the long axis of the organ (Fig. 5041) _ the stitches themselves running transversely.

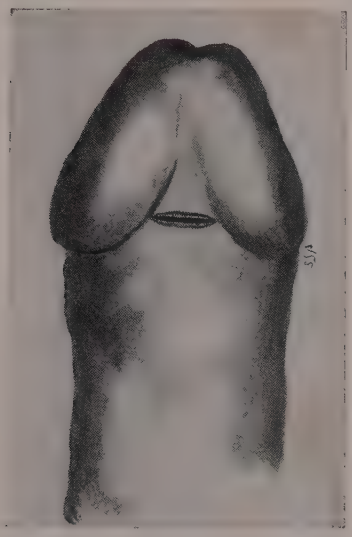


Fig. 5040.—Plastic Operation for Shortened Frenum _ I; _ A transverse cut is made over the contracted frenum.

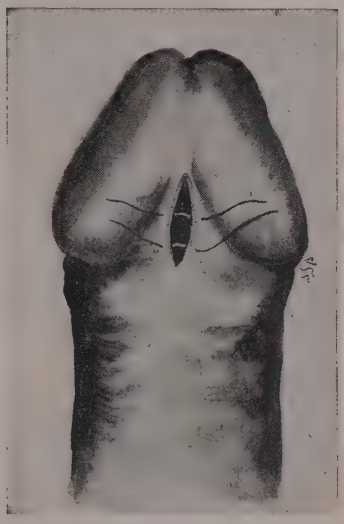


Fig. 5041.—The Same _ II; _ Suturing the transverse wound in an axial direction.

OPERATION FOR DOWNWARD CURVATURE OF THE PENIS CAUSED BY MEDIAN FIBROUS BANDS

This condition is apt to be associated with congenital deformity of the organ, such, especially, as hypospadias _ the correction of each condition presenting difficulties of its own. Operations for hypospadias are considered at length (v. pp. 728–743).

In the present instance downward curvature from fibrous bands will alone be considered _ a condition such as is shown in Fig. 5042.

In order to get greater length of skin covering over the ventral aspect of the organ _ even at the cost of slightly decreasing the girth of the penis at the site involved (which is a less material consideration) _ an elongated lozenge-shaped area of skin, the long axis of which corresponds with the length of the organ is removed _ the length and width of the area of skin to be excised being dependent upon the grade of deformity (Fig. 5043). When the resulting wound is sutured by transversely running stitches the tendency will be, besides the excision of the fibrous band, to elongate the penis in proportion as the width of the excised lozenge of skin is increased. The result of the suturing is seen in Fig. 5044.



Fig. 5042.—Operation for Curvature of the Penis Caused by Median Fibrous Bands – I; – A fibrous band extending from the frenum to the scrotum is shown. Some deficiency of the urethra is apt to coexist.



Fig. 5043.—The Same – II; – An elongated median, diamond-shaped piece of tissue, including the fibrous band, has been excised – after which the area is sutured transversely.



Fig. 5044.—The Same – III; – The entire wound is sutured by transversely running stitches – except for two extra stitches, in an opposite direction, which may sometimes be required at the center.

PARTIAL EXCISION OF THE URETHRA FOR TUMOR INVOLVEMENT, FOLLOWED BY ADVANCEMENT OF THE URETHRA

CATHELIN'S OPERATION

This technic is available in favorable cases of tumor situated near the glans penis.

The tumor and the portion of the urethra immediately above and below it are exposed by a modified form of elliptic incision. The urethra is dissected from its bed, from its meatal end, to a point proximal to the tumor _ where it is transversely divided (Fig. 5045) _ the segment of urethra and the tumor being removed *en masse*. Only as limited a portion of the urethra as possible is removed. The urethra immediately proximal to the segment excised is then mobilized (v. Fig. 5045, **b**) _ after which it is brought forward and sutured into the bed formerly occupied by the excised urethra by means of buried catgut sutures _ its terminal end being sutured into the site of the meatus.

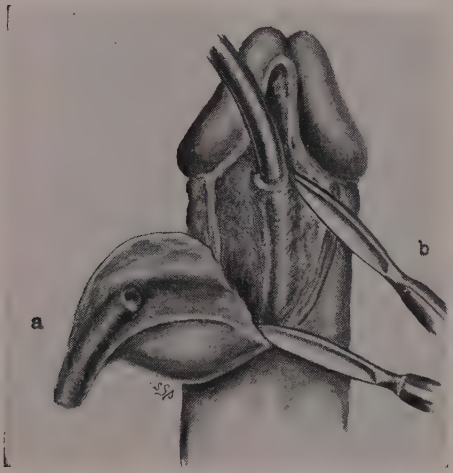


Fig. 5045.—ADVANCEMENT OF THE URETHRA IN EXCISING A TUMOR OF THE PENIS INVOLVING THE URETHRA _ I: _ **a**, Excising the tumor mass, with the distal portion of the tumor attached; _ **b**, freeing the urethra (into which a catheter has been introduced) _ so that the proximal portion of the urethra, when mobilized, will reach the end of the glans.

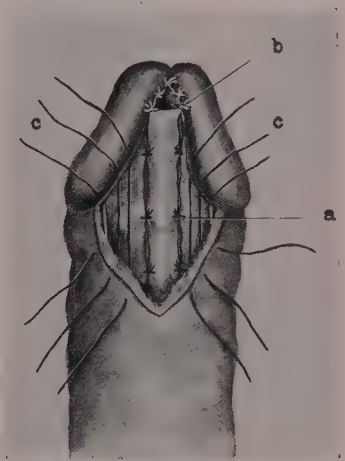


Fig. 5046.—The Same _ II; _ The new urethra is sutured to its bed laterally, **a**, and at the site of the meatus, **b**. The triangular wound is here sutured transversely, **c**, **c**.

Finally, the margins of the skin are united over the advanced urethra. In the accompanying illustration (Fig. 5046) the closing stitches are shown, by Legueu, to be placed transversely to the longer axis of the wound, which would tend to shorten the parts _ and may be a wise procedure in those cases where so much of the urethra has been removed that anchorage of the remaining portion might be difficult without some degree of shortening of the penis as far as suturing can accomplish this. Where these conditions do not exist, however, it might be well to let the stitches be placed transversely to the long axis of the penis.

PLASTIC OPERATION FOR RECOVERING WITH SKIN THE ENTIRELY DENUDED PENIS

REICH'S OPERATION

In the unusual cases in which the whole penis may be deprived of skin, as from burns, it becomes of the greatest importance to provide a new covering

of skin, or face the serious results of distortion during subsequent healing and fibrous contraction.

In Reich's procedure this skin covering is secured from the scrotum, whose skin grows to the raw organ during a temporary residence beneath its surface. The operation is performed in two stages.

The abdominoscrotal skin is circularly incised around the base of the penis, at its junction with these structures, for the purpose of mobilizing the base of the organ, and as preparation for the tunneling of the scrotum (Fig. 5047). A second incision, transverse, is carried through the skin of the lower anterior

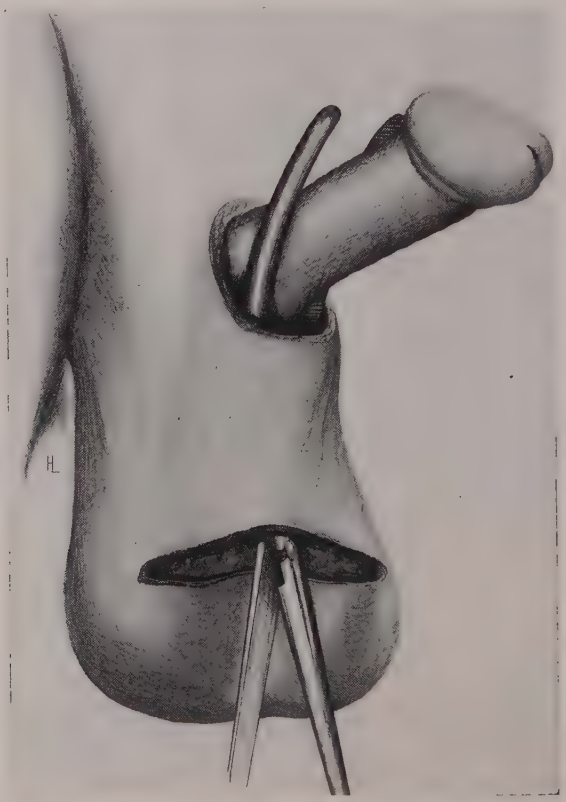


Fig. 5047.—Reich's Plastic Operation for Entire Loss of Skin of the Penis. I; Freshened, denuded body of penis, circular incision around the base of the penis, transverse incision across the lewer aspect of the scrotum. A broad passage between these incisions is being cleared by blunt dissection. Forceps are in the act of drawing the denuded penis beneath the bridge of scrotal tissue.

aspect of the scrotum, extending sufficiently far on each side of the raphé to enable the penis to be drawn through. By means of Mayo scissors or a blunt dissector or the spreading blades of forceps the skin of the scrotum between the circular and transverse incisions is tunneled in its connective-tissue plane. A pair of long, curved forceps is passed upward from the lower wound, and carefully seizing the raw penis, draws it downward through the scrotal tunnel as shown in the illustration just quoted. Both the upper and lower incisions are now sutured about the penis as accurately as possible — above, the scrotal skin is sutured to the abdominal skin, over the base of the penis — and, below, the median aspect of the scrotal skin is sutured to the base

of the glans penis, and the lateral aspect of the scrotal skin above, on each side, is sutured to the lower margin of the transverse scrotal incision, below _ the parts being adjusted as shown in Fig. 5048. This completes the first step of the operation.

About three weeks are allowed for union _ for not only must union itself occur, but time is thus given for the establishment of circulation into the flap from the center of its base, and the establishment of capillaries between the scrotal flap and raw surface of the penis. The scrotal flap is finally raised by making two longitudinal incisions, connecting the ends of the lower transverse incisions, with the prolongation outward, on each side, of the line of upper suturing. It will be necessary to again cut through the lower scar, from the lateral aspects of the penis, to the line of the vertical cuts, and to

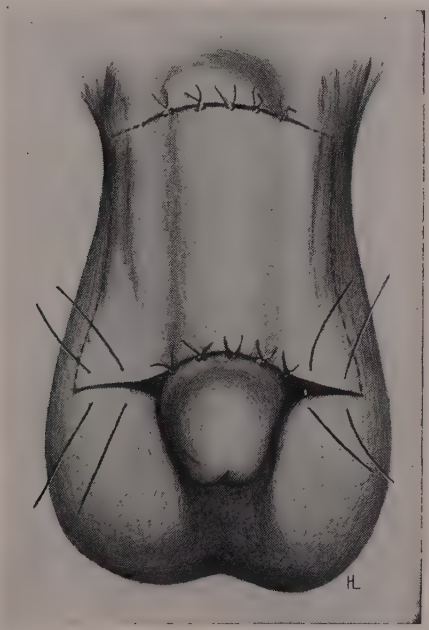


Fig. 5048.—The Same _ II; _ The penis is buried in its temporary bed during the time that scrotal skin is growing to its body. The circular wound at the base, near the peno-abdominal junction, is sutured. The lower portion of the flap is attached to the glans penis medially _ and united to the opposite scrotal tissue laterally. Dotted lines show sites of future flaps to be raised to cover the under aspect of the penis when it is cut away from the scrotum.

extend the upper section outward on each side. In other words, an apron of scrotal skin is provided which will be amply large to completely surround the penis when detached _ so that an overcalculation is better than a miscalculation of covering, even though the final lines of incision have to be more extensive than the original incisions. In dissecting away the penis from its scrotal bed the original contour of the organ is sought to be preserved as well as the general symmetry. When the organ and its covering blanket of scrotal skin is finally freed, the lateral aspects of the scrotal flap are wrapt around the penis and sutured in the median line _ and the upper and lower ends of the flap are sutured, respectively, to the base and to the glans of the organ.

Finally, the margins of the scrotal tissues are mobilized and brought to-

gether by sutures as well as possible _ any uncovered area being of scrotal tissue bed, from which the flap was raised, grafted, or left to granulate.

OPERATIONS OF CIRCUMCISION, OR PARTIAL EXCISION OF THE PREPUCE, FOR PHIMOSIS

General Features.—Circumcision, as the term is usually employed, consists in the removal of the greater portion of a prepuce which is either redundant or contracted _ for the purpose of allowing the glans penis to be more freely or more easily exposed. Where a part or the whole of the prepuce is removed for disease, as in some venereal conditions, the procedure might be termed a partial or total excision of the prepuce _ even though the removal be accomplished by circular section _ and although the cause for the removal be contraction caused by the disease. This refinement of difference, however, is of no essential importance.

The amount of foreskin to be removed should be so calculated, that two objects be accomplished: _ first, that enough prepuce be removed to insure easy exposure of the entire glans penis, even when the organ is at its maximum, during erection, _ and, second, that enough foreskin be left to insure the constant covering of the prominent corona glandis during relaxation of the organ, thereby securing the retention of greater sensitiveness of the papillæ than when the corona is worn constantly bare, and, therefore, dry _ and,

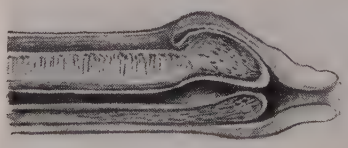


Fig. 5049.—Sectional View of the Contracted Prepuce in the Newborn.

consequently, less sensitive to stimuli during sexual intercourse. A bald-headed penis is a negative discomfort to its owner, and a positive discredit to the Surgeon responsible for it (unless some special pathology demands it).

The chief indication for circumcision is phimosis _ which is generally congenital, but may be pathologic or even traumatic. It may also be indicated to perform circumcision in order to reach disease of the glans or even of the reflected portion of the prepuce.

In the manipulations during circumcision it is to be remembered that the skin and the mucosa of the prepuce are freely movable upon each other, upon the connective-tissue bed common to both _ and that, unless special care be exercised to properly adjust the parts prior to all transverse sections of the prepuce, the skin will be almost invariably cut much shorter than the mucosa. A sectional view of infantile phimosis is seen in Fig. 5049. It is also to be remembered that one is apt to cut the frenum _ which is never necessary, and should always be avoided, as the structure heals slowly and with considerable discomfort.

Preparation.—The parts are thoroughly cleansed, and are disinfected as well as possible _ exposing the glans for the purpose. If such a degree of phimosis be present that the foreskin cannot be drawn back from the glans, then this part of the preparation must be abandoned _ unless irrigating fluids can be injected beneath the tight prepuce. A rubber catheter or cord is

usually tied around the base of the organ for the purpose of controlling hemorrhage, which, though not great, may be annoying.

Anesthesia _ Analgesia.—In the newborn the operation is usually performed without either anesthesia or analgesia. In young children anesthesia

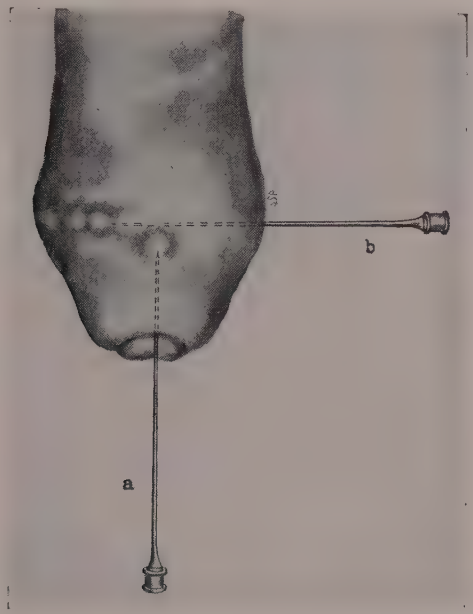


Fig. 5050.—Infiltration Analgesia of the Prepuce for Circumcision: _ a, Line of dorsal infiltration; _ b, line of circular infiltration around the entire prepuce.

is often required. In adults novocain analgesia is generally employed (Fig. 5050).

Position.—The patient is supine, near the edge of the table. The Surgeon may stand upon either side _ but usually upon the patient's right.

Landmarks.—Position of the sulcus, at the junction of the head and body of the organ, just posterior to the prominent corona glandis. The contour of

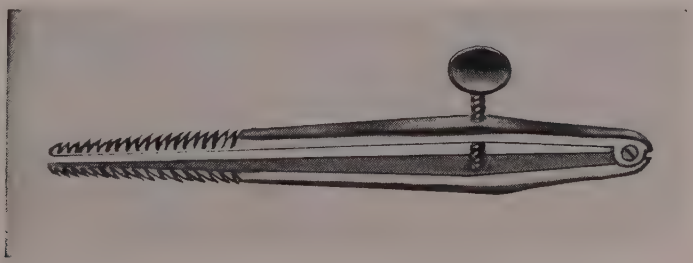


Fig. 5051.—Levis' Prepuce Dilator and Tractor.

the glans penis, which is usually recognizable beneath the movable prepuce. It is quite likely that the extreme end of the unrecognized and prepuce-covered glans has been cut off, more or less frequently, along with the foreskin.

Many mechanical aids to circumcision have been devised _ and many technics worked out, in spite of all of which it remains a fact that it is rare

to see a circumcision exceptionally well done, although a minor operation. Clamps and tractors have been especially devised, such as shown in Figs.

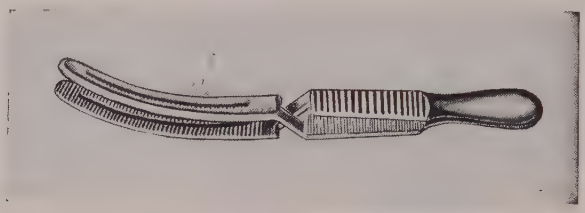


Fig. 5052.—Skillern's Phimosis Forceps.

5051–5054, for aiding in circumcision – but the operation can generally be quite satisfactorily performed with ordinary scissors, and with or without



Fig. 5053.—Spitzy's Phimosis Clamp.

clamps – and by such means greater accuracy is usually obtainable in providing the exact amount of prepuce which it is well to leave.

Silk or silkworm filament may be employed in suturing. Catgut, however, has the advantage of not having to be removed _ which, in the very young, is a considerable factor.

Stout scissors are especially serviceable (Fig. 5055).

Circumcision by Digital Adjustment of Skin and Mucous Flaps.— As there will be a much greater tendency for the skin aspect of the prepuce to retract more than the mucous membrane aspect, it is well, in all methods of circumcision, as a preliminary step to the actual division of preputial

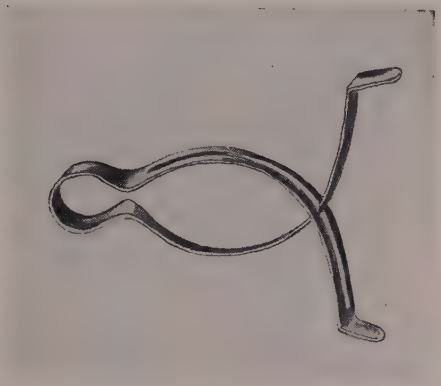


Fig. 5054.—Penis and Urethral Compressor.

tissue, to take the skin and mucous surfaces of the foreskin between the left index and thumb and so dispose the parts that the mucous membrane is drawn slightly forward and the skin pushed slightly backward _ that there will be somewhat less disparity when the section is made.

Taking the foreskin in the left fingers, the surgeon inserts the lower blade of a pair of straight scissors of the Mayo type, beneath the upper aspect of the foreskin, between it and the dorsum of the glans _ and cuts through the prepuce with one stroke, up to the height upon the dorsum which it has been

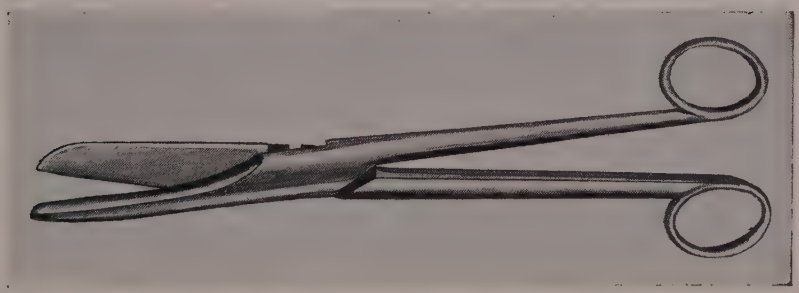


Fig. 5055.—Taylor's Phimosis Scissors.

calculated will leave sufficient prepuce to cover the corona during relaxation of the organ (Fig. 5056). The scissors are then withdrawn from the vertical incision _ and the position of the hands then changed. The left fingers grasp the left flap, the one nearer the Surgeon, and, holding it slightly away from the glans, the scissors are made to cut through one-half of the circumference of the organ _ the guide for the cut being that is should pass about parallel with the corona glandis, crossing the median line upon the under aspect of

the prepuce just in front of (distal to) the frenum (Fig. 5057). The right flap is now dealt with in the same manner _ completing the encircling of the organ. The incision will, therefore, slope obliquely from above downward and from behind forward. Four primary chromic gut sutures are then applied in the midpoints _ above, below, and laterally _ closely approximating the margin of mucous membrane to the margin of skin. These are followed by four or eight secondary sutures evenly distributed between the primary ones (Fig. 5058). The dressing is so applied as to leave an opening for urination.

Comment.—The usual error is to remove too much foreskin. A prepuce, appearing to be sufficient after the completing of the operation, often gets

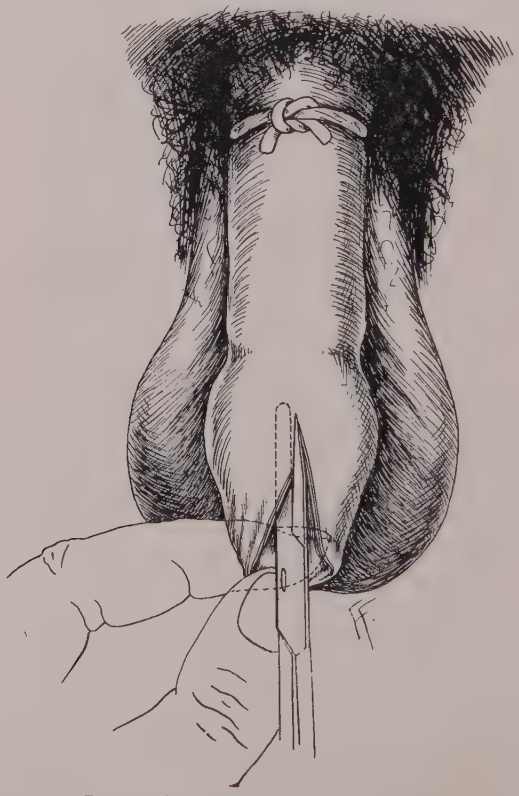


Fig. 5056.—Circumcision by Digital Adjustment of Flaps _ I; _ Scissors blade between glans and prepuce, cutting foreskin in median dorsal line up to level of its removal.

entirely and permanently behind the corona in subsequent retraction _ at the expense of considerable loss of sensitiveness of the papillæ.

If any question arise, during operation, as to the width of the opening being too narrow, the vertical incision may be extended upward additionally high _ the lateral incisions then being sloped downward so as to come just in front of the frenum.

The redundancy of the mucous membrane is apt to be much greater than that of the skin.

In using all forms of circumcision clamps too much or too little prepuce is apt to be cut away.

If the penis is to have a preliminary constrictor applied, which would tend to draw back the foreskin into a somewhat unnatural position, greater accuracy in measurements may be obtained by first (before applying the tourniquet) marking the site at which the removal is desired with a nitrate of silver stain.

Sometimes one or more vessels have to be twisted or gut ligatured.

Do not leave too great an amount of tissue near the frenum.

It may be necessary before suturing to trim the edges somewhat, especially of the mucous membrane, with scissors.

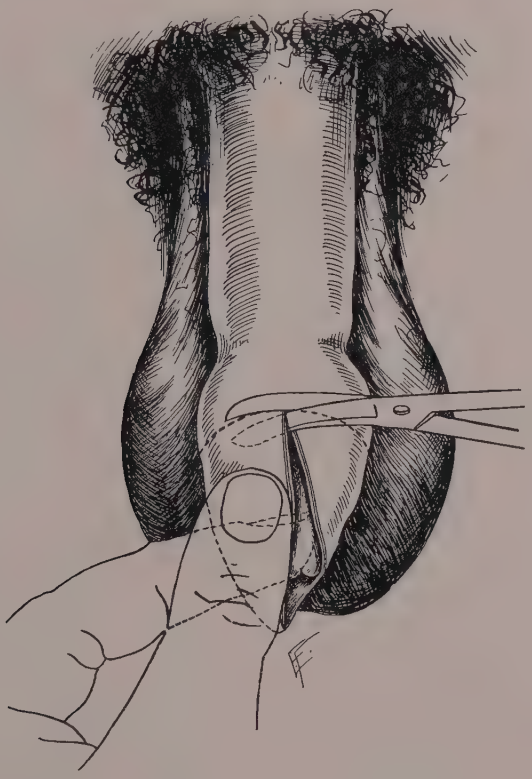


Fig. 5057.—The Same—II;—Division of the entire thickness of the prepuce transversely at the upper limit of the median incision. While the entire redundant portion of prepuce is being drawn downward the left thumb and index so manipulate the parts that more of the mucous membrane than of the skin is removed.

Where there is firm adhesion between prepuce and glans, especially in children, the prepuce must be carefully peeled off—by means of the fingers, aided by toothed forceps and the flat portion of a probe.

Often in adherent prepuces no instrument can be slipped up between the prepuce and glans—and the opening of the prepuce is too small to allow of retracting the membrane far backward—in which cases the redundant portion must be put upon tension and cut off transversely, after which the separation of adhesions may be more easily accomplished.

In operating in adherent cases readhesion is prevented by removing an excess of mucous membrane and leaving a slight redundancy of skin. In com-

pleting the operation the skin is sutured to the shorter mucous membrane – and, being quite long, is doubled upon itself, and the part in contact with the glans eventually becomes of the nature somewhat of mucous membrane.

Circumcision by Instrumental Adjustment of Skin and Mucous Flaps (Legueu).—This technic represents the substitution of two hemostatic forceps for the fingers – in the preliminary adjustment of the proportional allotment of skin and mucosal contribution to the flap covering which is being calculated – the clamps also serving as tractors of the free prepuce during the manipulations. It will be seen in Fig. 5059 how the two clamps grasp the sides of the mucocutaneous reflection at the free margin of the prepuce. The original grip of the margin by the clamps is aided by the thumb and first finger, which either rolls the skin inward or the mucosa outward, as indicated in calculating the proportional distribution. When all is in readiness, the skin only is cut through by sweeping a sharp knife lightly

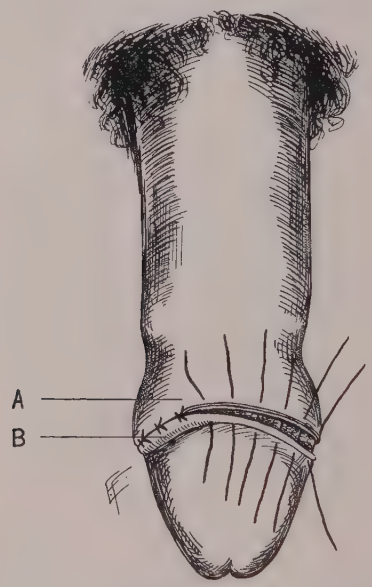


Fig. 5058.—The Same – III; – Placing of interrupted sutures – which approximate the free edge of the skin (A) to the free edge of the mucous membrane (B).

along a line about parallel with the corona glandis – and sufficiently below it to insure having enough prepuce left, after suturing, to always cover the glans in relaxation. The mucosa is then divided by scissors paralled with but below the line of skin division (Fig. 5060). When skin and mucosa are sutured together the mucosa will be slightly redundant – but will eventually become likened to the skin.

Circumcision by Instrumental Adjustment of Skin and Muceus Flaps (Taylor).—The anterior aspect of the free margin of the prepuc is seized on each side by two hemostatic forceps (Fig. 5061), after which a median incision is made with a pair of scissors along the dorsum of the prepuce, up to a level which is still far enough below the corona glandis to insure ample covering for this structure during relaxation of the organ. When the median incision has been made, the two sides of the mucocutaneous flaps are held aside, and, with a pair of scissors, the prepuce is obliquely divided

along a line parallel with the corona – making the necessary provision for length just mentioned – as shown in Fig. 5062.

Circumcision Aided by Preputial Clamp.—A straight or, better, slightly curved clamp of light type and with blades of medium length is used. If a curved clamp be used, the concavity or convexity may be directed forward, as seems indicated in the special case. The foreskin, grasped between the Surgeon's left thumb and forefinger, or between forceps, in the same way,



Fig. 5059.—Circumcision Under Traction of Foreskin by Catch Forceps – I; – The division is to be made obliquely along the dotted line, with a knife, through the skin only.

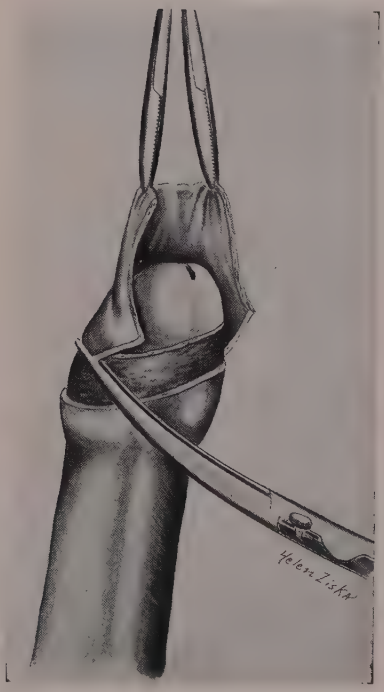


Fig. 5060.—The Same – II; – On the line of the retracted skin the mucous membrane is divided by scissors.

so that its lateral aspects are approximate, is drawn outward after carefully and properly adjusting skin and mucosa – and the clamp is applied, obliquely from above downward, in such a way as to be about parallel with the prominent corona glandis (Fig. 5063) rather than at a right angle with the axis of the organ. With a pair of curved scissors the free portion of the foreskin is cut away along the anterior or distal margin of the lightly compressed clamps. The section is sometimes, though less evenly, made with a knife. Even with

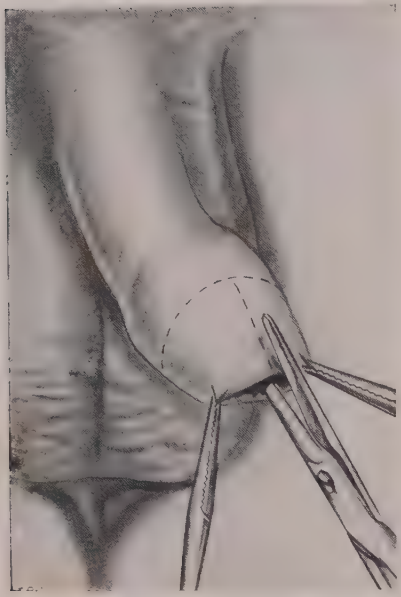


Fig. 5061.—Circumcision by Instrumental Adjustment of Skin and Mucous Flaps – I; – Grasping the free margin of the prepuce with hemostats (so as to secure a longer mucosal than cutaneous flap) – and dividing the prepuce, medially, up to the level of the circular division.



Fig. 5062.—The Same – II; – Completing the oblique, circular excision of the redundant portion of the prepuce – leaving ample preputial tissue to cover the base of the glans penis during relaxation of the organ.

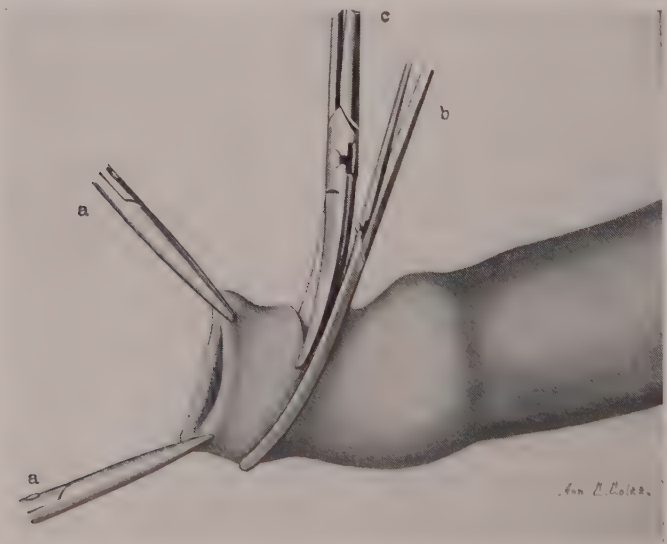


Fig. 5063.—Circumcision by Means of Special Clamp and Curved Scissors – I: – a, a, Tractors of redundant prepuce, – b, curved forceps clamping drawn-out foreskin distal to and parallel with the glans; – c, scissors excising redundant portion of prepuce along clamp.

the best calculation it is quite common to find, especially when operating with clamp control of the prepuce, that the foreskin is considerably longer

than the skin when the clamps are removed. If this be the case, the redundant foreskin should be seized with forceps and the unneeded excess circularly excised by scissors (Fig. 5064). The margins of skin and mucosa are now sutured together with fine catgut. In the technic described by Watson and Cunningham (Figs. 5065 and 5066), after tying the sutures, their ends are left long – so that these ends may hold in contact with the raw circle of sutured

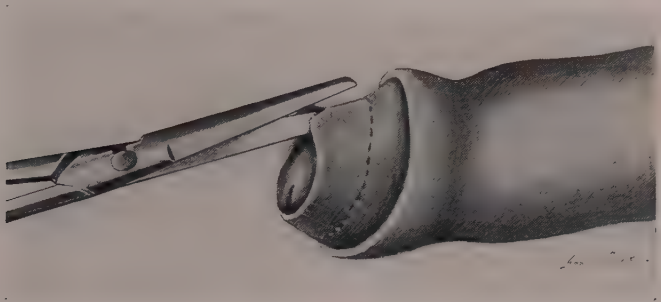


Fig. 5064.—The Same – II; – Removing some of the redundant mucosa which is often left after the first cut. The dorsal splitting of the part to be removed is followed by circular division along the dotted lines – so planned as to leave enough prepuce to permanently cover the corona glandis.

margins, a gauze-collar dressing, by tying the ends over the dressing. This from of dressing, however, as pictured shows the glans penis left entirely uncovered by the sutured free end of the prepuce – as does also the method of dressing shown in Fig. 5067. As mentioned in several places, the circumcised prepuce should always be planned, and worn, below the level of the corona glandis – and an ordinary type of circular dressing is all that is necessary.

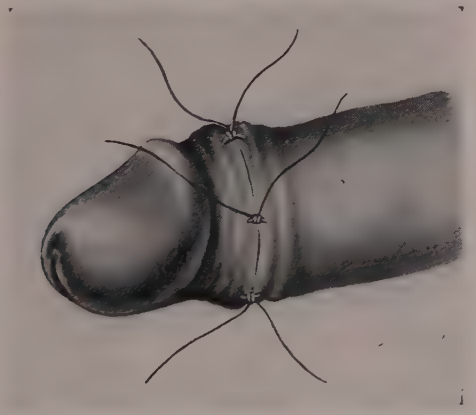


Fig. 5065.—The Same – III; – Interrupted sutures of skin and mucosa – left long to tie in the gauze dressing.

Circumcision by Allis' Method.—A somewhat complex incision is made – at first carried through the skin only. A circular cut is carried completely around the end of the foreskin at the base of the contracted tip (Fig. 5068). Upon the median ventral aspect of this incision, an oblique incision on each side, is carried downward and slightly outward, toward the corona glandis, and as far as considered necessary for the making of the cuff-like covering of the gland, which is the feature of the operation. At this last level, nearer the

corona, the knife is swept, circularly, around the foreskin, everywhere except at the base of the inverted V. The skin portion of the prepuce bounded by these cuts is now dissected away from the mucosa and discarded. The distal circular cut, at first through the skin, is now deepened through the mucosa –

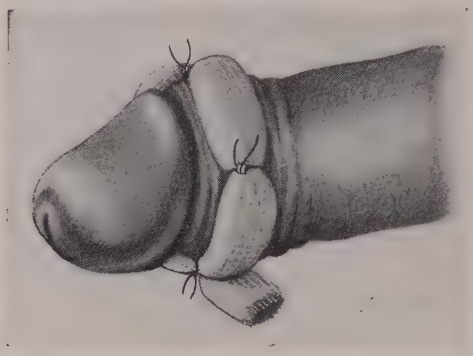


Fig. 5066.—The Same – IV; – Application of dressing – in the form of a collar of gauze held in contact by the long ends of the sutures tied over it.

and the end of the prepuce thus removed – as shown in Fig. 5069. The skin portion of the prepuce now tends to retract above the corona. The mucous portion of the prepuce, which is the only part still covering the glans, is usually still too tight to admit of being folded backward – so that a median, ventral incision is made from the free margin down to the skin. The appearance



Fig. 5067.—Gauze Dressing Following Circumcision – applicable to those cases in which the foreskin has been accidentally cut so short that it lies posterior to the corona glandis.

of the parts is now as seen in Fig. 5070. The distal portion of the free mucosa is finally folded backward toward the base of the glans, cuff-fashion – and its free margin everywhere sutured, with fine catgut, to the free margin of retracted skin – both along the circular and the inverted V-shaped portions

of the cut (Fig. 5071). It will be seen that provision is thus made for the permanent covering of the sensitive glans penis.

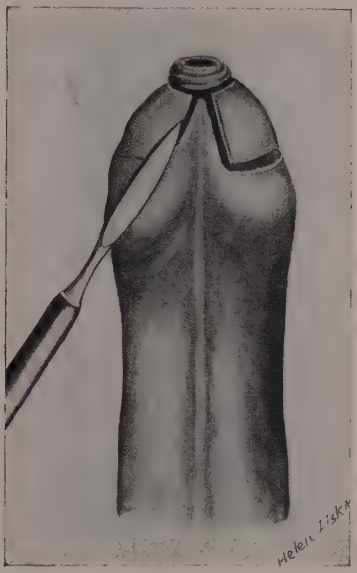


Fig. 5068.—ALLIS' CIRCUMCISION – I; – Whip-cord ending of foreskin is outlined by incision preparatorily to its removal. The knife is deepening the area to be partially excised.



Fig. 5069.—The Same – II; – The skin half of the foreskin has been removed. The mucous aspect of the other half is in the act of being incised along the dotted line and removed.

Circumcision by Écrasement (Doyen).—An écraseur, angiotribe, or strong type of compression forceps is employed. One blade of the écraseur is slipped



Fig. 5070.—The Same – III; – The skin aspect of the foreskin has been entirely removed, and a liberating incision made over the frenum to give greater freedom.

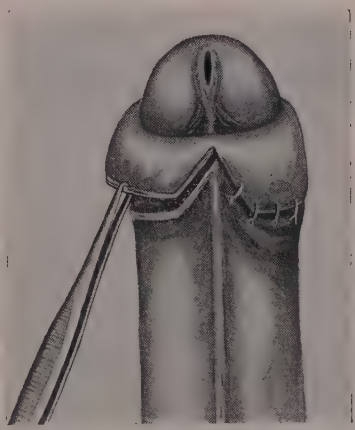


Fig. 5071.—The Same – IV; – The cuff of mucosa is being everted and its margin sutured to the free edge of the skin just made.

beneath the median line of the dorsal aspect of the prepuce, between glans and mucosa – as far toward the corona glandis as considered necessary to

leave enough foreskin to cover the glans when the parts are sutured. The tissues in the path of the écraseur are crushed to exsanguination by the firm

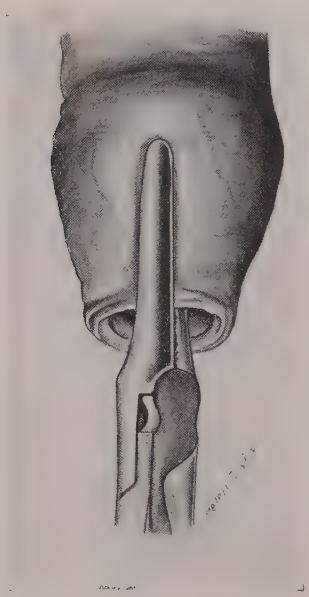


Fig. 5072.—Circumcision by Écrasement – I; – Crushing the foreskin in the median line by angiotribe.



Fig. 5073.—The Same – II; – Dividing the prepuce in the medially crushed tract with scissors – after which the prepuce will be crushed and divided circularly in the dotted lines.

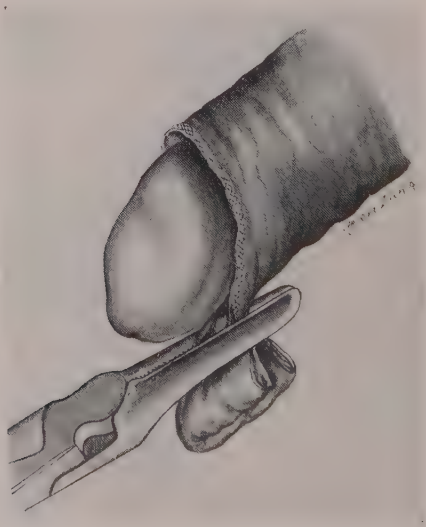


Fig. 5074.—The Same – III; – Crushing the two folded flaps in the region of the frenum.

compression of the handles (Fig. 5072). The free margin of the prepuce in this pathway may even be crushed entirely through. When the écraseur is

withdrawn one blade of a pair of blunt-pointed scissors replaces the under blade of the écraseur, and cuts through the crushed path of the compressor (Fig. 5073). Next, parallel with the corona glandis, and at a sufficient distance from it, the excess of prepuce is circularly crushed from the median dorsal aspect nearly to the frenum. The circular crushing is followed by circular division by scissors in the crushed path. Finally, the two halves of the prepuce are folded backward, beneath the organ, skin surface to skin surface, and similarly crushed with the écraseur _ and then divided by scissors _ as seen in Fig. 5074. The crushed and cut margins are then sutured with interrupted or continuous catgut stitching.

Circumcision in the Newborn by Means of the Écraseur (Doyen).—A thin plate of aluminum, or other substance, is passed through the preputial orifice, the redundant prepuce being drawn well outward over it _ the edge of the metal pointing directly upward and downward in a vertical axis. The écraseur is then applied in the same plane _ and made to compress the parts for two minutes _ and is then removed (Fig. 5075). The excess of prepuce is then cut off in the crushed path (Fig. 5076).

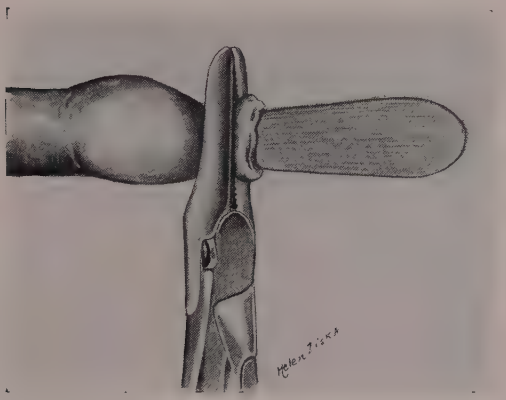


Fig. 5075.—Circumcision in the Newborn by Means of the Écraseur _ Doyen _ I; _ A thin plate of aluminum, or other metal, or substance, is inserted within the prepuce _ upon which the drawn-out prepuce is crushed by an écraseur.

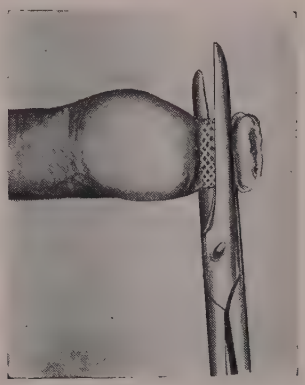


Fig. 5076.—The Same _ II; _ The crushed prepuce is divided about 2 mm ($\frac{1}{12}$ inch) distal to the proximal line of the crushed area.

Comments.—Not only may there be unpleasant bleeding following circumcision which may cause considerable annoyance before control _ sometimes, in the case of a child, requiring a second anesthetization _ but the nicety of primary union may be entirely interfered with by the formation of a hematoma between the cutaneous and mucous aspects of the sutured margin of prepuce _ so distending and breaking down the stitches as to require opening the wound, ligating the vessel, and resuturing the edges _ or the acceptance of union delayed by granulation. Thorough hemostasis during operation, therefore, is clearly indicated. And if a rubber tourniquet be used while operating, to control bleeding, this should be loosened *before* suturing the edges of the wound _ that further ligation of vessels may be then made _ rather than be required later.

An adult usually objects to lying abed for a day or two _ which, while desirable, is not absolutely necessary _ if the dressed organ be held up against the abdominal wall by a loose binder.

It is questionable whether a baby, with its constantly wet diaper, is not

better off by having the part merely smeared with vaselin, following the stitches, than to be in constant contact with urine.

It will sometimes happen in any circumcision, but especially in the infantile type, that such dense adhesions bind the preputial mucosa to the glandular mucosa that they cannot be separated by finger, probe, or grooved director – and, unless this freeing can be accomplished, headway in the operation is blocked. A practical way of overcoming this, applicable in adult or child, is to make a temporary transverse division of the prepuce as near the glans as possible, or a median dorsal incision of short length, if one blade of the

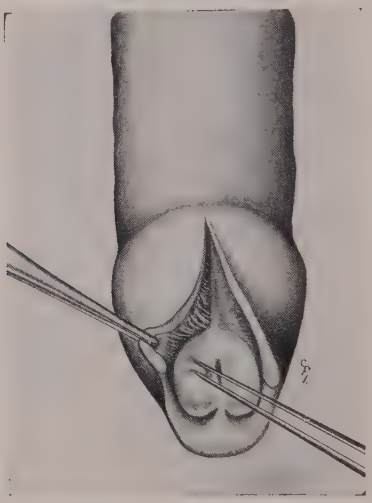


Fig. 5077.—Method of Separating Preputial Adhesions in the Course of Circumcision; – The margin of the mucosa of the axially divided prepuce is seized with ribbed forceps, and the mucosa of the glans is steadied by another pair – while the former is peeled from the latter – as one peels the skin of an orange from the fruit.

scissors can be slipped under the prepuce – and then pick up the mucosa with forceps while steadying the glans with another forceps, and peel the mucosal surfaces apart (Fig. 5077).

CIRCUMCISION, WITH COMPLETE EXCISION OF THE MUCOSA

It is sometimes necessary to excise practically the whole preputial mucosa in some conditions of disease. The skin alone is first divided parallel with and a short distance below the corona glandis (Fig. 5078, **a**). This is done with sharp-pointed scissors traveling in the connective-tissue plane. When the circular sweep has been completed, the partially free prepuce is seized with a clamp and put upon tension – which, as the skin has been circularly divided, will pull out the mucosa (Fig. 5079, **c**), aided by the retraction of the severed skin, until it can be cut at a much higher level than the skin was divided (at the level represented by **b** in Fig. 5079) – which amounts to excising almost the entire preputial mucosa. When the division of skin and mucosa are complete their margins are sutured together – as a result of which the margin of the longer skin will be slightly infolded to meet the margin of the shorter mucosa in the postcoronal sulcus.



Fig. 5078.—Circumcision with the Removal of the Entire Mucosa – I; – a, Site of the circular skin incision; – b, site of the circular division of the mucosa. (Figs. 5078 and 5079 modified from Doyen.)

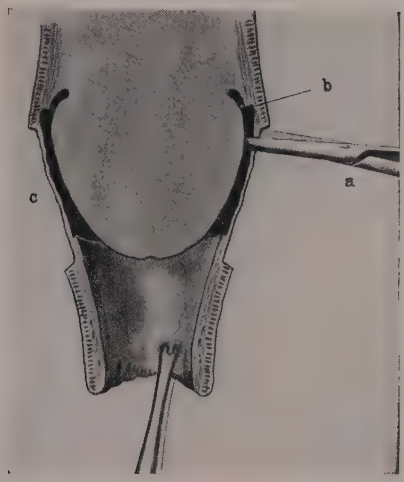


Fig. 5079.—The Same – II; – Forceps grasping skin and mucosa, under traction, put the intervening connective tissue and vessels on the stretch, c – making hemorrhage unlikely, as the circular division is accomplished along the level of the cut skin, a. The level of the cut mucosa is shown at b.

AMPUTATIONS OF THE PENIS, IN GENERAL

Amputation of the penis may be partial or complete – in the former more or less of the free portion of the organ is removed – in the latter, the entire organ, including all of the corpus spongiosum and the crura, together with the division of the deep urethra.

Cancer of the penis is the most frequent – indeed, almost the only – indication for amputation. If the cancer do not involve the organ further back than 2.5 cm. (1 inch) behind the corona glandis, partial amputation may be performed. Involvement further back than this, and yet not without all reasonable bounds as to the growth itself and lymphatic involvement should be followed by total amputation. Some Surgeons may be inclined to give a little more leeway than the strict 2.5 cm. (1 inch) posterior to the corona line – provided ample sound tissue intervenes between the growth and the peno-abdominal wall – and yet observance of the first statement is undoubtedly, safer – and, further, that statement is strengthened when one remembers that, besides allowing 2.5 cm. (1 inch) from the growth, a second allowance is necessary to get covering for the amputation stump.

In all amputations of the penis for cancer, partial or complete, both the superficial inguinal glands (into which the lymphatics of the penile skin empty), and the deep lymphatic glans (into which the lymphatics of the glans empty) should be invariably removed on both sides – thoroughly – and whether apparently involved or not. After infection has passed from the deep lymphatic glands, through the crural canal, to the external iliac group of glands, surgical help is, as a rule, hopeless.

Apart from the fact that it is safer, on general principle, in dealing with cancerous conditions not to try to partially amputate the penis if the growth extend further backward than 2.5 cm. (1 inch) behind the corona glandis, is the added fact that when the amputation is performed at the penoscrotal junction the anchored urethra retracts considerably, and the difficulties of

urination may be more disagreeable than if the urethra emptied upon the perineum.

PARTIAL AMPUTATIONS OF THE PENIS

Description.—Partial amputation of the penis consists in the removal of more or less of the free portion of the organ _ followed by the covering of the stump by some previously planned adjustment of the adjacent penile skin, and the anchoring of the divided urethra at the end of the divided organ. The operation is usually called for in epithelioma not involving the penis further back than 2.5 cm. (1 inch) behind the corona glandis. Some atypical type of partial amputation may be demanded as a result of injury to the organ or as a result of some non-cancerous disease. See Amputations of the Penis in General, p. 775.

Preparation.—The local preparation of the part is of the usual nature, in so far as the condition of disease will allow, for which the amputation is performed. If the distal end of the organ be occupied by some prominent malignant lesion, as is usually the case, this is strongly disinfected (after anesthesia or analgesia), and protected with gauze dressing, so as not to soil the sound portion of the wound. Both inguinal lymphatic regions are also prepared.

Position.—Patient supine, at edge of table. Surgeon usually stands upon the patient's left _ the Assistant opposite.

Landmarks.—Site and nature of involvement. Line of section. Bilateral furrows between the corpora covernosa and the corpus spongiosum.

Analgesia _ Anesthesia.—In atypical partial amputations for other than malignant disease, infiltration analgesia usually suffices, with novocain _ and may also be employed in other partial amputations. But since partial amputation is usually called for in cancerous involvement of the penis _ and since, when operation is performed for this condition, both inguinal lymphatic regions must also be thoroughly dissected, the operation, as a whole, almost always calls for anesthesia.

Hemorrhage Control.—A rubber tourniquet (usually a rubber catheter) is placed around the base of the organ. A short piece of soft-rubber catheter is passed into the urethra, down to the tourniquet, and anchored at the meatus, to emphasize the furrow between the corpora cavernosa and corpus spongiosum _ as a useful means of aiding in the recognition of these parts during the manipulations. (See Comments, p. 783.)

The ground covered above applies in general _ independently of the type of partial amputation to be adopted _ several of which will be here given. There is a great deal in common, as far as technical principle is concerned, between amputations about the penis and amputations about the upper or lower limb.

Partial Amputation of the Penis by Long Dorsal and Short Ventral Flaps.—The covering for the stump comes from both dorsal and ventral aspects of the organ, but chiefly from the former.

Incision.—The anterior flap will have a width of one-half the circumference of the penis at the line of division, and a length of about one diameter of the penis. The posterior flap will have the same width of base, and a length of about a half diameter of the penis.

Operation.—Having decided upon the line of section of the penis, an anterior or dorsal flap of skin and connective tissue is cut, having a width of half the circumference of the organ at the line of division, and a length about equal to the diameter of the organ (Fig. 5080). This is raised up by dissection and turned back _ the dorsal arteries being tied with gut. On a level with

the base of the anterior flap the divisional groove between the corpora cavernosa and corpus spongiosum is recognized, aided by the soft catheter in the



Fig. 5080.—Partial Amputation of Penis by Long Dorsal and Short Ventral Flaps. I; Outlining of flaps: A, Long anterior flap; B, short posterior flap.

urethra. A narrow-bladed knife, held flatwise, with back of blade backward, is thrust horizontally through the organ, between the cavernosa and spongio-

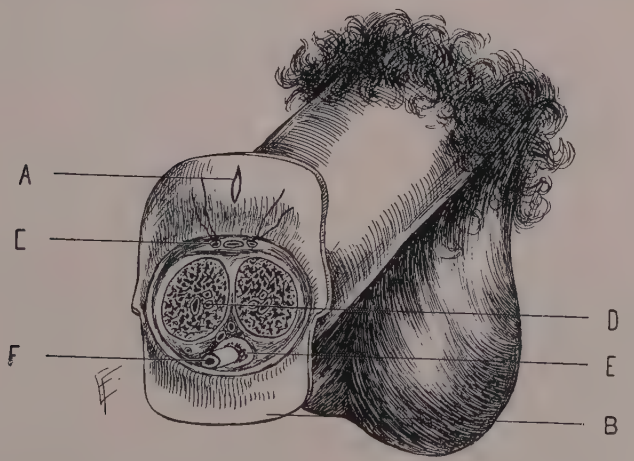


Fig. 5081.—The Same. II; Transverse section of stump: A, Long anterior flap turned back, showing slit for urethra; B, short posterior flap; C, dorsal vein and arteries; D, corpora cavernosa and vessels; E, corpus spongiosum; F, urethra dissected out and ready to be sutured into slit of anterior flap.

sum and cuts its way through, passing at first directly forward in the groove and then rounding abruptly downward thus forming an inferior flap of about one-half the diameter of the penis in length, composed of corpus spongiosum,

with its included urethra and skin. The urethra is now dissected out from the small inferior flap, back to a line with the base of the flaps. The corpora cavernosæ are divided transversely from within outward and upward on a line with the highest point of transfixion (base of flaps) (Fig. 5081). The arteries of the corpora cavernosa are tied with gut.

Make a vertical incision in the center of the long anterior flap opposite the urethra and just large enough to receive the urethra. The urethra is then drawn through this opening. If the urethra be much too long, the redundancy is cut off, leaving a protrusion of about 7 mm. ($\frac{1}{4}$ inch) – which is slightly slit above and below – and sutured into the margins of the opening in the anterior flap. The two flaps are then united by suture both where their free ends meet – and where in apposition laterally (Fig. 5082). A dressing is applied, leaving room for urination – at the same time exercising pressure of the flap against the stump of the penis.

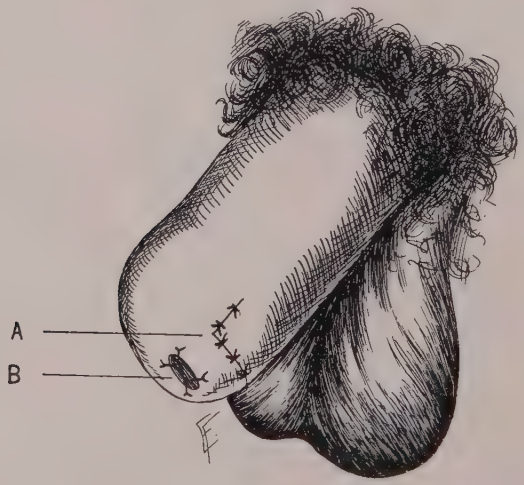


Fig. 5082.—The Same – III; – The parts sutured: – A, Suture line of flaps; – B, urethra sutured into slit in long anterior flap.

The arteries of the corpus spongiosum and of the septa may need ligating.

Following the completion of the partial amputation the inguinal lymphatic glands of both sides are to be removed by independent dissection (v. Vol. II, p. 222.

Partial Amputation of the Penis by Long Dorsal Flaps.—A single large flap of skin and connective tissue, whose base is one-half the diameter of the organ at the line of section, and whose length is somewhat greater than the diameter, is outlined upon the dorsal aspect of the penis. At the upper ends of the two limbs of these two incisions a transverse incision is drawn between them over the ventral aspect of the organ. Coaptation of the parts, subsequently, will be better if this transverse cut is placed a little distal to the proximal ends of the flap incision (which, however, really constitutes a very small ventral flap, and, therefore, makes it resemble, in a way, the method last described) (Fig. 5083). This dorsal flap is freed up to the line of section (and the miniature ventral flap as well) – after which the penis is divided transversely. The urethra (which should be cut as long as possible) is mobilized sufficiently for anchorage into a vertical slit made in the anterior dorsal

flap, as it is dropped over the end of the penis and sutured to the free margin of ventral skin.

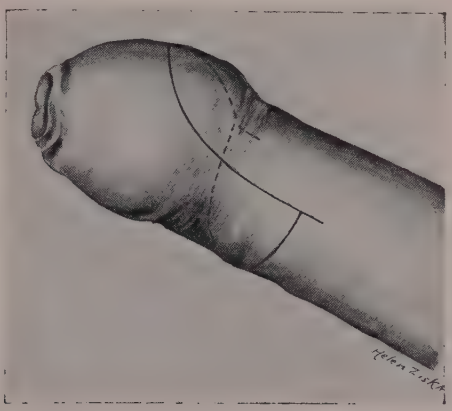


Fig. 5083.—Partial Amputation of the Penis by Dorsal Flap.

Partial Amputation of the Penis by Long Ventral Flap.—This technic is the reverse of the preceding (the former probably being preferred by the majority of Surgeons). A desirable advantage which it has over the previous

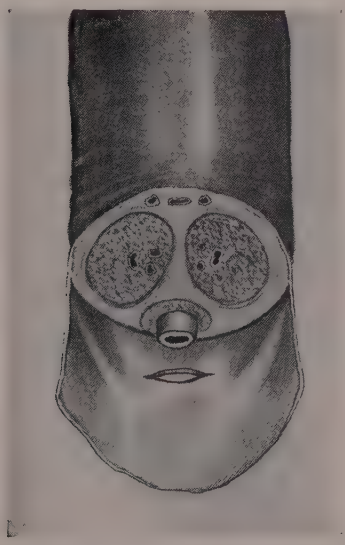


Fig. 5084.—Partial Amputation of the Penis by Long Ventral Flap;—The corpora cavernosa have been divided transversely, and the corpus spongiosum similarly, but a little longer. The ventral flap has been slit for the anchorage of the urethra—and is ready to be carried upward over the face of the amputated penis and sutured to the dorsal skin.



Fig. 5085.—Partial Amputation of the Penis by Racket Incision.

operation is that the suture line is brought upon the dorsum of the penis—and is not, therefore, made wet during the act of urination. In the present

instance a ventral flap is outlined – whose measurements are calculated in the same manner as in the procedure last described, reversing the positions. When the skin flap has been dissected back to the line of amputation, and retracted, the blade of a long, narrow bistoury is inserted, flatwise, with its back toward the base of the penis, and the blade is carried, in this position, between the corpus spongiosum and the corpora cavernosa until the entire diameter of the organ is transfixed – after which the cutting edge of the knife is turned toward the dorsum of the penis, and cuts abruptly and transversely outward through the corpora cavernosa in a sweeping, saw-like movement. The corpus spongiosum is then dissected out until about 1.3 cm. ($\frac{1}{2}$ inch) of its distal end is free, when it is transversely divided – longer, to this extent, than the corpora cavernosa (Fig. 5084). After controlling all bleeding vessels by ligation a vertical slit is made in the ventral flap (the corners of which have

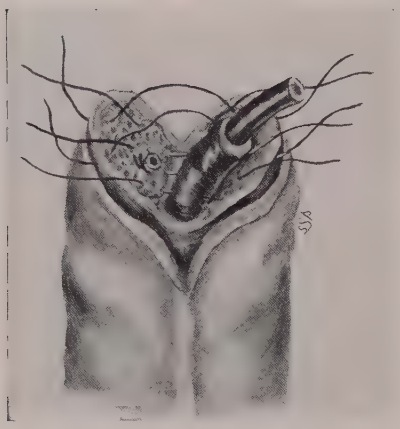


Fig. 5086.—Kalliontzis' Partial Amputation of the Penis by Lateral Flaps – I; – Having retracted the skin, the body of the penis is amputated by bilateral flaps – taking care to dissect out the urethra at somewhat greater length. The main vessels are ligated. Deep, buried sutures approximate the corpora cavernosa and control hemorrhage.



Fig. 5087.—The Same – II; – The portion of the penis corresponding with the corpora cavernosa is approximated and sutured laterally. The urethral mucosa is sutured to the skin – leaving a termino-inferior urethral opening.

been rounded) – which is then carried upward and its margin sutured to the margin of the dorsal incision. The urethra is anchored into the slit of the flap.

Partial Amputation of the Penis by Racket Incision.—The straight limb of the racket is placed over the urethra (Fig. 5085). The skin covering is freed back to the proximal end of the handle of the racket – at which level the penis is transversely divided. The wound is sutured in a straight dorso-ventral line, in the course of which the end of the urethra is anchored.

Partial Amputation of the Penis by Bilateral Flaps (Kalliontzis' Method).—Two equal lateral flaps are outlined – their highest points being over the median dorsal and median ventral aspects of the penis. Part of a rubber catheter is first placed in the urethra to aid in defining the outline of the corpus spongiosum. The flaps are then cut by transfixion – so guiding the transfixing knife to one side of the corpus spongiosum outlined by the

contained catheter, that it be not cut. Later the urethra is dissected from the opposite side (Fig. 5086). All visible vessels are tied with fine catgut. The two lateral flaps are then brought together, first, by a tier of buried catgut

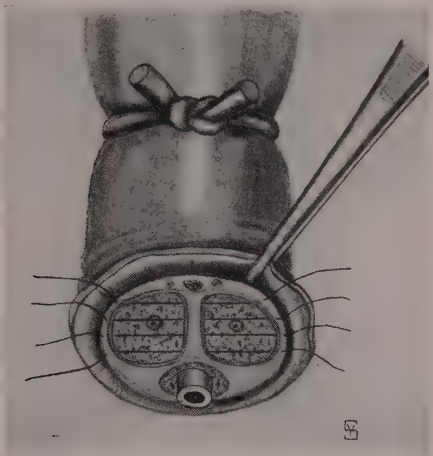


Fig. 5088.—Partial Amputation of the Penis by the Circular Method _ I; _ Having controlled hemorrhage by rubber tourniquet, the skin is circularly divided far enough down to afford ample covering for the stump at the site of amputation _ after which the skin is retracted to that level and the corpora cavernosa and corpus spongiosum divided transversely _ planning to leave the urethra somewhat longer.

stitches, and, finally, by a second deep tier through the free fibrous borders of the corpora cavernosa _ and last of all the skin margins are sutured _ and the urethra anchored in the wound (Fig. 5087).



Fig. 5089.—The Same _ II; _ The outer, fibrous walls of the corpora cavernosa are sutured in the median line _ and the urethra is split, terminally, from before backward.



Fig. 5090.—The Same _ III; _ The skin is sutured in the median line _ the urethra being anchored in the terminal suturing.

Partial Amputation of the Penis by Circular Incision.—Having decided upon the level at which the penis is to be amputated, the skin is circularly divided sufficiently far below this to furnish an ample covering for the sectioned

organ _ a distance equivalent to somewhat more than a half-diameter. The divided skin is then drawn backward, or rolled backward, cuff-like, toward the base of the penis, to the line of amputation, and the corpora cavernosa divided _ but when the corpus spongiosum is reached care is taken, after dividing this structure at the same level, to divide the urethra about 6 cm. ($\frac{1}{4}$ inch) longer than the corpora cavernosa (Fig. 5088). The severed vessels are tied with fine catgut. Buried catgut sutures are also passed transversely through the margins of the fibrous coverings of the corpora cavernosa _ which are then brought together in the manner shown in Fig. 5089 _ thereby giving a more natural rounded end to the organ _ and controlling bleeding by compression. The projecting end of the urethra is limitedly split upon its dorsal and ventral aspects (v. Fig. 5089) _ to provide against retraction _ and the



Fig. 5091.—Partial Amputation of the Penis by Transverse Division of the Corpora Cavernosa and Oblique Division of the Corpus Spongiosum _ I; _ The penis is amputated after retracting the skin _ the vessels are tied _ and deep sutures are so placed as to approximate the corpora cavernosa laterally in a vertical line.



Fig. 5092.—The Same _ II; _ The portion of the body corresponding with the corpora cavernosa is sutured laterally. The urethral mucosa is sutured to the skin.

split end of the tube is sutured into the lips of the medially and dorsoventrally approximated lips of the skin (Fig. 5090).

Partial Amputation of the Penis by Elliptic Incision.—Instead of making a purely circular division of the penis a somewhat elliptic contour is given to the cut _ the section being made transversely through the corpora cavernosa and obliquely through the corpus spongiosum. The skin is first divided in an obliquely elliptic fashion _ after which it is retracted, and the deeper parts are then cut in the manner described _ as pictured in Fig. 5091. Two methods of suturing are available. The fibrous sheaths of the corpora cavernosa may be brought together by buried catgut sutures passed transversely (v. Fig. 5091) _ after which the skin margins are brought together so as to form a median dorsoventral line when sutured _ the margins

of the split urethra being sutured into the lower angle of the wound (Fig. 5092). This method makes the more symmetric ending for the organ. On the other hand, the fibrous sheaths of the corpora cavernosa may be sutured together by stitches running dorsoventrally (Fig. 5093) _ so that this buried suture line will run transversely. The skin in this, as in the preceding instance, is brought together around the urethra, but is more puckered than in the method just mentioned (Fig. 5094).

Comments.—The use of the rubber tourniquet is deprecated by many Surgeons _ as its use upon such a part is more or less traumatizing _ interferes with the little room there is for manipulation _ draws the skin back unnaturally _ is more apt to be followd by erections of the stump _ and is more apt to be followed by hemorrhage in so far as it makes it more difficult to

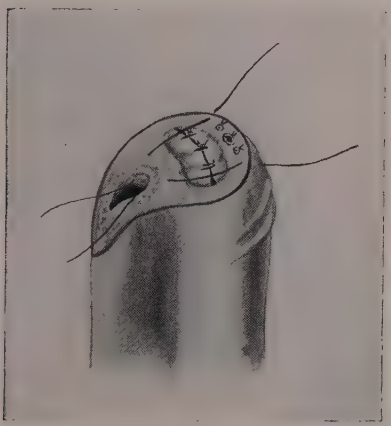


Fig. 5093.—Partial Amputation of the Penis by Transverse Division of the Corpora Cavernosa and Oblique Division of the Corpus Spongiosum _ III; _ An alternate method of suturing the stump. The corpora cavernosa are approximated anteroposteriorly. Two mucocutaneous stitches are seen in position.



Fig. 5094.—The Same _ IV; _ The mucosa is everywhere drawn out and sutured to the skin _ with greater tension superiorly than inferiorly.

recognize small but possible bleeders. If the Surgeon be dextrous and ordinarily rapid in his work the digital control of an Assistant is all that is really needed.

COMPLETE AMPUTATION, OR EXCISION OF THE PENIS, THROUGH THE TEMPORARILY SPLIT SCROTUM

PEARCE GOULD'S TECHNIC

Description.—In the total amputation of the penis the entire structure is removed as indicated by the designation _ including both corpora cavernosa and the corpus spongiosum _ with division of the spongy urethra and the anchorage of its proximal end in the perineal wound. The removal of the parts is accomplished through an incision which surrounds the base of the organ, temporarily splits the scrotum, and passes down the midperineum to its midpoint. The inguinal lymphatic glands of both sides are removed by separate, disconnected incisions, or by incisions extending from the main wound. The usual indication for the operation is epithelioma of the penis _ which has either recurred or which first appears too near to the abdominal wall to admit of partial removal of the organ.

Preparation.—The penis, scrotum, perineum, and both inguinal regions are shaved and prepared in advance. The lower abdomen and upper thighs are also prepared and protected. Any cancerous growth present is throughly cauterized and protected from soiling the wound. A soft catheter anchored in the bladder will aid in defining the scrotoperineal urethra during the scrotoperineal stages of the operation.

Position.—The patient supine, at the end of the table, in the lithotomy position during the excision of the organ _ and supine and in the horizontal posture during the removal of the inguinal glands. The Surgeons stands or sits between the patient's limbs during the removal of the organ _ and stands to one or the other side during the clearing of the inguinal lymphatic tracts.

Landmarks.—Penoscrotal junction _ subpubic arch _ perineal raphé _ contour of the catheter-distended urethra _ inguinal tracts.

Note.—While the operation, as devised, consisted in the removal of the entire penis first _ and then the dissection of the inguinal tracts _ yet it is a question as to whether it would not be better to begin the operation with the thorough dissection of the inguinal glands, that no fiuids from the cancerous tract might be squeezed backward into the wound during the somewhat vigorous manipulations required, even though the glands be cut off from the source of infection by division of the skin _ just as, at the present time, so many Surgeons, for the same reason, begin extensive breast removals for cancer with the dissection of the axilla.

Incision.—The incision circularly surrounds the base of the organ at its junction with the abdominal wall _ and is then continued down the median line of the scrotum and into and along the median line of the perineum, to its midpoint.

Operation.—Incise the scrotal tissues exactly in the median line, from the under surface of the penis, at its junction with the scrotum, to and into the perineum. Separate the two scrotal sacs by blunt dissection, in their fibrous partition, until the corpus spongiosum is reached. All bleeding vessels are clamped and ligated as encountered. If a catheter or metallic sound be previosuly introduced through the urethra, the incision and subsequent dissection are made easier. If a sound have not been previously introduced, a large-sized metallic sound is now passed through the urethra up to the triangular ligament to aid in defining the corpus spongiosum. The corpus spongiosum is then dissected out until free in its entire circumfereuce. The sound is then withdrawn _ and the spongy urethra is divided well in front of the triangular ligament _ and the proximal end of the urethra is then freed back to the triangular ligament.

Carry the upper end of the vertical incision circularly around the base of the penis. Divide the suspensory ligament _ and expose the corpora cavernosa. The corpora cavernosæ are to be followed down to their attachment to the rami of the pubes and ischia _ and freed from their attachment chiefly by blunt but partly by sharp dissection (Fig. 5095). The dorsal arteries are tied after cutting through the suspensory ligament, and the arteries of the corpora cavernosa generally require ligation when the cavernosæ are freed from the bone. Bleeding from the vesicoprostatic plexus of veins is often considerable, and is to be controlled by pressure and hot water. The proximal end of the membranous urethra is now turned downward and sutured into the perineum _ the mucous membrane of the former being sutured to the skin of the lips of the perineal wound. If necessary the urethra may be split so as to enable its lips to be more readily sutured into the perineal wound. The remaining perineal and all the scrotal portions of the wound, and the circular area formerly

occupied by the base of the penis, at the peno-abdominal junction, are all sutured in one straight anteroposterior line (Fig. 5096).

Two temporary drains should be inserted into this long and deep wound – one, at its upper end, as an utlet from the region of the vesicoprostatic plexus,

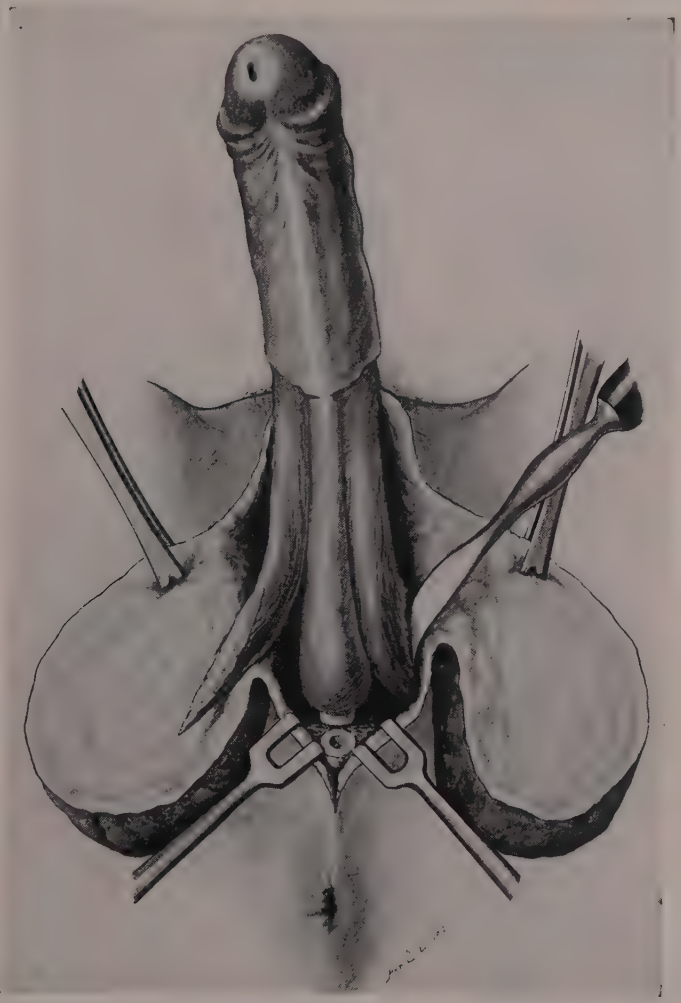


Fig. 5095.—Total Amputation of the Penis by Splitting the Scrotum – I; – Through an incision encircling the base of the penis, bisecting the scrotum, and continued on upon the median perineum, the crura and corpus spongiosum are exposed, and the scrotum split and thrown apart bilaterally, saddle-bag fashion. The left crus is being detached from the ischial ramus by a periosteal elevator. The right crus has been detached. The spongy urethra is here shown divided closely behind the bulb and left long, to be anchored to the perineal skin level, anterior to the triangular ligament – its division really being accomplished after the separation of both crura.

from which oozing may occur – and the other, at the lower end, into the perineal tissues (v. Fig. 5096).

The lymphatic glands of both inguinal regions are to be removed – and this may be done preliminarily, as mentioned above – and, if not then, should be done in concluding the operation for the removal of the organ. The general

features bearing upon the excision of the inguinal lymphatic glands is given in Vol. II, p. 222.

The special technic advised by Burghard for the removal of the lymphatic glands bilaterally, which should be carried out with absolute throughness in connection with excisions of the penis, partial, or total, is the following: – In each pubo-inguinal region a crescentic incision, with downward convexity, is carried across the groin – beginning just inferior to the external abdominal ring and rounding downward over the groin to a level about 7.5 cm. (3 inches) below Poupart's ligament – and thence upward again, to a point on Poupart's line about 2.5 cm. (1 inch) inside of the anterior superior iliac spine. This oval

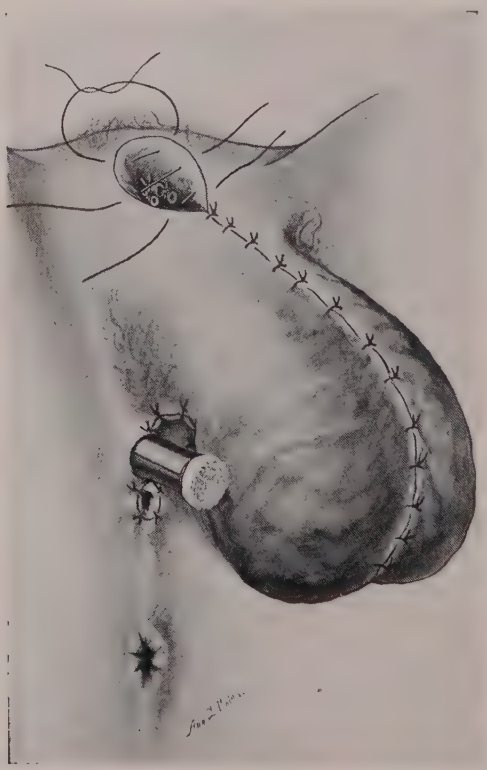


Fig. 5096.—The Same – II; – The scrotal sacs are united in the middle line by buried and superficial sutures. The distal end of the membranous urethra is sutured into the lowest part of the perineal wound. The dorsal vein and arteries are shown tied. A gauze drain is inserted into the deep perineum. (Modified from Watson and Cunningham.)

flap, with downward convexity, is then dissected out and retracted upward over Poupart's line. The glandular structures are thoroughly excised *en masse* if possible. Burghard stresses the importance of also excising, simultaneously, the cutaneous lymphatic area, which passes from the dorsum of the penis to the superficial group of lymphatic glands – and states that it will generally be indicated to ligate and divide the internal saphenous vein well within the saphenous opening – and the gland within the crural canal as well. He further states that if this gland within the crural canal have become adherent, it would be well to abandon the operation – as it would argue too wide-spread infection to make the operation worth while. Following

the removal of the lymphatic glands of both sides the two flaps through which they were exposed are turned back and sutured into position – with the provision for a temporary drain beneath both, between a stitch or two, left untied until after the withdrawal of the drains.

The incisions just described for clearing out the inguinal lymphatic structures may readily be extended to become continuous with the upper lateral limits of the major incision through which the penis itself is removed.

Comments.—The perineal urethra should, after division, be freed backward as far as the triangular ligament.

A semisharp, curved periosteal elevator has proved about the best instrument with which to separate the crura of the penis from the ischiopubic bones, to which they are very firmly attached. Less bleeding will accompany this technic than when they are freed with curved, blunt-pointed scissors.

In freeing the suspensory ligament and working through the vesicoprostatic plexus of vessels the bleeding may be quite considerable, and the venous oozing from the venous branches may fill the wound cavity and obliterate all view of the parts – but firm packing with gauze for a few moments or douching with very warm water will usually control it. All recognizable sources of bleeding should, of course, be at once clamped and then ligated.

While it would seem that most Surgeons first separate the crura from the ischiopubic bones through the vertical portion of the incision, from the penoscrotal junction, to the midperineum, and finally detach the penis from the pubic arch, the Author has always preceded in the opposite direction – first surrounding the base of the penis by the encirling, or slightly elliptic incision, and splitting the scrotal sac, and carrying the incision into the perineum, after which the penis is at once freed from its pubic attachments until the two crura can be outlined – and then follows down the outer aspects of these, until each is separated, in turn, from its bony attachments.

As mentioned in the body of the article, the cutaneous lymphatic area intervening between the penis and the inguinal glands should be removed along with the latter.

The divided spongy urethra is usually anchored about 2.5 cm. (1 inch) in front of the anus into each side of the perineal skin that has been brought together in the median line. Sometimes the lips of the urethral end are first split anteroposteriorly.

COMPLETE AMPUTATION, OR EXCISION OF THE PENIS, BY COMBINED PUBO-INGUINAL AND PERINEAL INCISIONS

TAYLOR'S TECHNIC

Description.—The inguinal lymphatic glands, bilaterally, are excised and the base of the penis freed by circular incision – as the first stage of the operation. The crura of the penis are then separated from the ischiopubic bones, and the spongy urethra divided through a median perineal wound and the detached penis removed through the pubic wound – as the second stage of the operation. The indication for the operation is cancer.

Preparation.—Practically the same as in the preceding operation.

Position.—The patient is in the supine position during the dissection of the inguinal glands, and the freeing of the base of the penis – and in the lithotomy position during the freeing of the crura of the penis and the division of the spongy urethra.

Landmarks.—As in the preceding operation.

Incisions.—Will be given in the course of the operation.

Operation.—Divided into two stages.

Dissection of the Inguinal Lymphatic Glands and Freeing of the Base of the Penis.—The one continuous incision for this stage of the operation is threefold _ following the fold of the groin on each side and surrounding the base of the penis _ as shown in Fig. 5097. The inguinal lymphatics are first excised. All visibly bleeding vessels are clamped and tied if necessary. The skin is undercut in the connective-tissue plane and retracted to each side, exposing the glandular structures _ which, together with their afferent vessels, are carefully excised *en masse* if possible from over the fascia lata, from the anterior superior spine inward. The vicinity of the femoral ring is dissected with especial care _ as efferents from the inguinal glands pass to the iliac glands through the femoral canal. The inguinal wounds are temporarily packed with gauze.

The incision encircling the base of the penis (and continuous on each side with the inguinal incisions) is now deepened around the penis at the penoscrotal and peno-abdominal junction _ and suspensory ligament of the

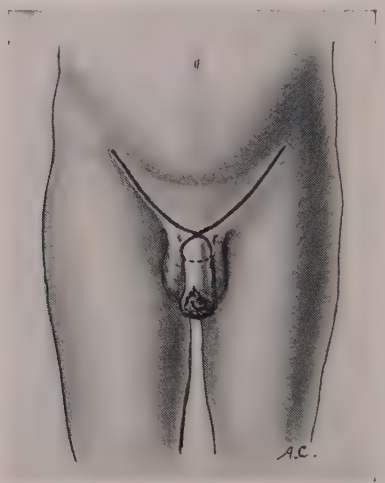


Fig. 5097.—Complete Radical Amputation of the Penis by Combined Pubo-inguinal and Perineal Incisions _ Taylor _ I; _ The incisions for exposing the base of the penis and the regions of the inguinal glands. A median incision is extended downward beneath the penis.

penis cut, and the organ freed from its connections with the pubic arch. The dorsal vein and arteries are clamped and tied. The beginning of the divergence of the two corpora cavernosa is exposed. The spermatic cords are guarded as they make their exit from the external abdominal rings. The subpubic wound _ as were the inguinal wounds _ is temporarily packed with gauze, which will largely control the bleeding from the venous plexuses of this region.

Freeing and Dividing the Perineal Urethra and the Crura of the Penis.—The patient is put into the lithotomy position _ and the scrotum is drawn upward, away from the anus, exposing the perineum. An incision is made in the median perineal line, extending from just behind the scrotum to within 1.7 cm. ($\frac{3}{4}$ inch) of the anus. This incision is deepened through skin and fascia until the accelerator urinæ is encountered, which is split medially, and retracted laterally (Fig. 5098) _ exposing the corpus spongiosum and its bulbous expansion. At a point about 3.7 cm. ($1\frac{1}{2}$ inches) anterior to the bulb, the corpus spongiosum is divided between forceps. A rubber bougie

is passed into the proximal end of the divided urethra, which is then freed from the corpora cavernosa _ and isolated backward as far as the triangular ligament (Fig. 5099), being left loose in the perineal wound for future anchorage.

The crura of the penis are now separated from the ischiopubic bones through the perineal wound _ preferably by semisharp, curved periosteal elevator. When the separation is nearly accomplished, but before the posterior aspect of each crus is finally freed, the terminal end of each crus is seized between two clamps to control the branch of the internal pudic which supplies it, and divided _ the proximal end of the vessel being controlled by ligating



Fig. 5098.—The Same _ II; _ The perineal incision _ through which the spongy and bulbous urethra are here seen exposed _ with the overlying accelerator urinæ muscle split and laterally retracted. (Figs. 5097–5099 modified from Taylor.)

the terminal ends of the crura. Any remaining attachments of the penis are divided. All bleeding vessels are tied. Finally, having freed the crura and divided corpus spongiosum everywhere between the pubic and perineal wounds, these structures are drawn upward through the wound and out of its pubic opening.

The divided proximal end of the spongy urethra is now anchored into the perineal wound half-way between anus and scrotum _ with its end protruding somewhat beyond the skin level to provide for some retraction _ and as the structure is sutured between the lips of the perineal wound, the reflected parts of the accelerator urinæ muscle are so sutured around it as to constitute a form of sphincter. A retention catheter is also anchored in the perineal

wound, by which the bladder has direct drainage, for two or three days. The rest of the median perineal wound, in front of and behind the anchored urethra, is closed by silkworm suture.

Replacing the patient in the supine position, and returning to the pubo-inguinal wound, with changed gloves, the temporary gauze packings are removed _ and the wounds examined to see that hemostasis is complete. The margins of the wound which surrounded the base of the penis are closed vertically _ and the wounds in the groins, through which the lymphatics were removed, are closed by suturing their edges.

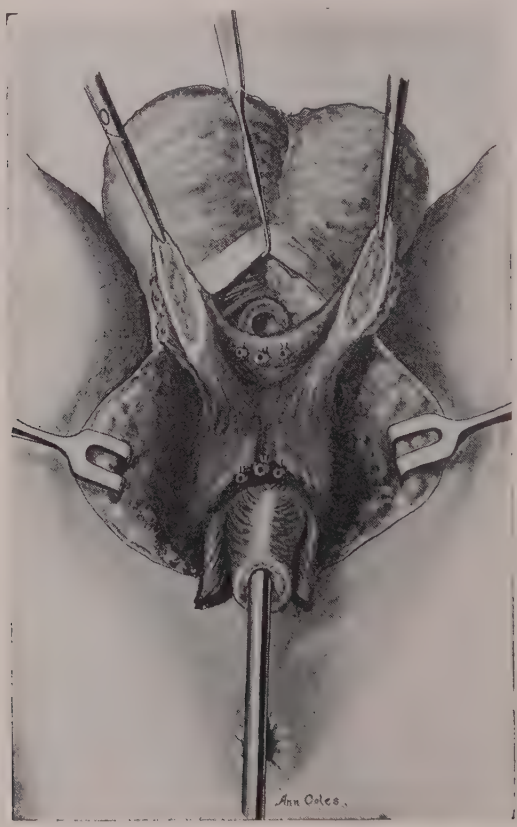


Fig. 5099.—The Same _ III; _ The spongy urethra has been divided, and its proximal end, occupied by a rubber bougie, freed backward, toward the triangular ligament. The corpora cavernosa have been detached from the ischiopubic bones _ and are being separated from the pubic arch. The dorsal vessels of the penis are seen ligated as they come from under the pubic arch _ and the vessels to the crura are controlled.

In any question of doubt it is wise to place a small temporary drain in each groin wound and in the deep perineal wound.

TOTAL RADICAL EXCISION OF THE PENIS, TESTES, AND SCROTUM, ALONG WITH THE INGUINAL LYMPHATICS

Description.—In the operation of total emasculation the penis, testes, and greater part of the scrotum are excised _ and the spongy urethra is divided

and anchored in the perineal wound. The inguinal lymphatic glands are also excised. The vasa deferentia are ligated at the external inguinal rings. This, naturally, is the most radical procedure in malignancy of the male genital region – and, when performed solely for the extensiveness of the disease, is, generally, for the very reason of the extensiveness, hopeless. On the other hand, when the removal of the testes, along with the excision of the penis, is carried out solely from the standpoint of making it easier for the patient, since he is losing his penis, not to retain the chief incentive to intercourse, the testicles, it has been noted that serious adverse results often follow – such as neuroticism, insanity, and death.



Fig. 5100.—Total Amputation of the Penis and Testes, Along with the Inguinal Lymphatics – I; – Lines of penoscrotal incision, if performed in two stages. Lateral portions of inguinal incisions are seen in Fig. 5097.

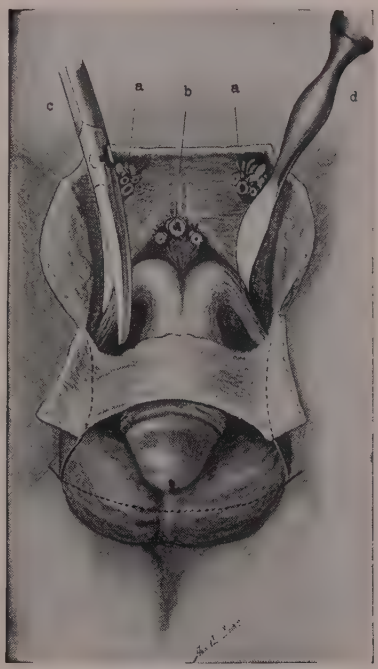


Fig. 5101.—The Same – II; – Deepening the lines of incision from above downward, the flaps are dissected downward and outward – the structures of the cords are ligated, **a**, **a** – and the dorsal vessels of the penis, **b**. The right crus is being divided by scissors at its attachment to ischium, **c**. The left crus is being entirely detached from its bony insertion by curved periosteal elevator, **d**.

The operation when performed is done in one séance of several steps.

Preparation – Position – Landmarks.—As in the preceding operation.

Operation.—The incision by which the inguinal glands of both sides are removed and the peno-abdominal junction of the penis exposed and the spermatic cords tied is extensive – beginning at one anterior superior iliac spine, and ending at the opposite one, curving downward, in its center, to the peno-abdominal junction, over the pubis (Figs. 5097 and 5100). Through this incision the inguinal lymphatic structures of both sides are thoroughly removed. The spermatic cords are isolated as they pass outward from the external abdominal rings, and are ligated and divided. In the median portion of the

wound the base of the penis is freed, its suspensory ligament divided, and the dorsal vessels of the penis ligated and divided _ and the beginning of the separation of the corpora cavernosa from the pubo-ischial rami is begun (in the same way as described in the preceding operations).

The scrotal and perineal incisions are now made, and these regions exposed. The lateral limbs of the scrotoperineal incisions pass downward from the long transverse cut which passed from one iliac spine to the other _ and, in its downward sweep over the scrotum, is given an inward incurvation, so disposed as to calculate sufficient covering, derived from the scrotum on either side, to meet in the final midperineal suture line (Fig. 5100). The scrotal incisions pass from the lateral aspects of the scrotum, onto the posterior scrotal aspect and finally cross the perineum obliquely, meeting in an obtuse point in the midperineal line, about midway between the scrotoperineal junction and



Fig. 5102.—The Same _ III; _ Closure of the bed of the wound; _ the partially excised right crus is sutured. The deep urethra is sutured into the perineal skin.

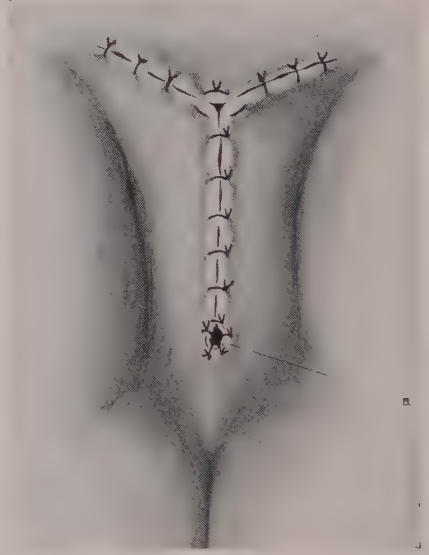


Fig. 5103.—The Same _ IV; _ Completion of the suturing of the flaps to close the inguinal and puboperineal wounds. Anchorage of the divided spongy urethra in the lower end of the perineal wound at a.

the anus. The scrotoperineal flaps thus outlined are dissected and retracted outward. The spermatic cords are exposed _ and if they have not already been ligated at the external abdominal rings, in the upper transverse incision, they are now freed up to that point and ligated. It is better to tie the vasa deferentia separately _ and the vessels of the cord separately _ rather than *en masse*. The testicles are then excised. Through the combined transpubic and scrotoperineal wounds the crura of the penis are finally separated from the pubo-ischial rami _ tying the vessels which run into their lower ends (Fig. 5101). Or they are sometimes separated from their bony attachments in greater part, then their lower ends are clamped, divided, and ligated _ after which the fibrous envelope of each crus is sutured over the stump. In Fig. 5102 total removal of a crus is shown on one side _ and partial removal, with ligation and suturing, upon the other. The spongy urethra is divided,

as in the preceding operation, freed somewhat toward the triangular ligament, and left ready to be anchored in the perineal wound.

The gauze packings which were temporarily placed in the transverse wound are now removed, and the wound sutured, leaving a temporary drain in the subpubic region if indicated. The margins of the scrotoperineal flaps are brought together and sutured in the median perineal line – during which the divided end of the spongy urethra is sutured into the lower end of the perineal wound – somewhat prominently forward (to allow for retraction), and its lips split if necessary. It is well to put a second temporary drain into the midperineal wound. The finally sutured incisions present the appearance shown in Fig. 5103. A drainage catheter is anchored in the bladder.

CHAPTER LXXIX

OPERATIONS UPON THE SCROTUM

Surgical anatomy of the scrotum, p. 795.
Operations for partial excision of the scrotum, p. 796; _ Total excision of the scrotum, p. 799.

SURGICAL ANATOMY OF THE SCROTUM

Description.—The scrotum is a cutaneo-musculo-areolar sac, investing the testes and part of the spematic cords. It is composed of skin and dartos _ the remaining layers mentioned below being, more properly, coverings of the testes and cords.

Skin.—Of characteristic appearance. Continuous with the general integument. Marked in the middle line by a raphé, which divides the scrotum into two lateral halves superficially.

Dartos.—Proper tunic of the scrotum _ composed of reddish, elastic, and unstriped muscle tissue _ continuous with the superficial and deep layers of the superficial fascia. Septum scroti _ formed by the dartos _ extending from the raphé to the inferior surface of the penis _ dividing the scrotum into two cavities for the two testes, the left cavity being the longer.

Intercolumnar or External Spermatic Fascia.—Derived from borders of pillars of external abdominal ring. Continuous with superficial perineal fascia and superficial fascia over the symphysis pubis. Loosely (Gray _ closely, according to Morris) adherent to the dartos. Intimately adherent to the cremasteric fascia.

Cremasteric or Middle Spermatic Fascia.—Fibromuscular layer derived from lower border of internal oblique muscle.

Infundibuliform Fascia (Fascia Propria or Internal Spermatic Fascia).—Connective-tissue layer derived from both the infundibuliform process of the fascia transversalis and also from the subperitoneal connective tissue (which latter may be considered a separate or sixth layer).

Tunica Vaginalis.—Closely connected with the testicles, with which it is described.

Arteries.—Superficial and deep external pudic of femoral; superficial perineal of internal pudic; cremasteric of epigastric.

Veins.—Correspond with arteries and empty into pudic, long saphenous, and dorsal vein of penis.

Lymphatics.—End in innermost set of inguinal glands.

Nerves.—Ilio-inguinal; superficial perineal branches of internal pudic; inferior pudendal branch of small sciatic; genital branch of genitocrural.

OPERATIONS FOR PARTIAL EXCISION OF THE SCROTUM

Description.—Removal of the lower portion of the scrotal sac. Generally resorted to in relaxation and elongation of the scrotum _ and as an aid in sustaining the scrotal vessels in varicocele.

Preparation.—Scrotum shaved and disinfected.

Position.—Patient supine, at edge of table _ with scrotum lifted upward and outward, from between the legs. The Surgeon usually stands upon the patient's left. The Assistant opposite.

Landmarks.—Contour of the testicles and vasa deferentia.

Operation.—Several different technical procedures are in use in excising the lower portion of the scrotum—differing chiefly in the manner in which the testicles are kept from harm during the operation—in the manner in which they are kept from escaping from the incised scrotal sac—and in the way in which hemorrhage is controlled. Some of the chief methods will be here described.

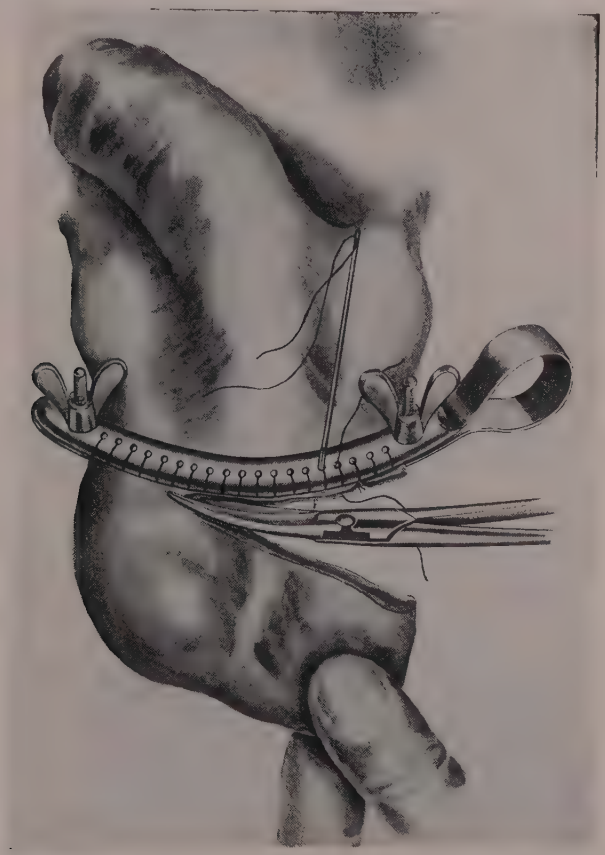


Fig. 5104.—Excision of Redundant Scrotum—under control of King's scrotal clamp;—Having pressed the testes upward and applied and compressed the clamp over the empty scrotal bag below them, the excess of scrotal tissue is excised just distal to the lower border of the clamp. The ligatures are then placed, by means of a long Keith needle, through the fixed holes in the clamp, and tied in the indicated grooves, while the clamp is still in position—after which the clamp is removed—and is not followed by any other suturing.

Excision of Redundant Scrotum Under Control of King's Scrotal Clamp.—The testicles are pressed upward, toward the abdominal rings, to be well above the possibility of injury. While the testes are thus temporarily held up by the Assistant, the Surgeon draws the empty scrotal sac between the loosely separated blades of the special clamp—and proceeds to evenly adjust its tissues along the width of the clamp, that the parts may be everywhere evenly compressed. When this has been accomplished, the end screws are tightened—not enough to traumatize the parts, but just sufficiently to control the blood-supply and to prevent the scrotal edges when cut from

slipping out of the grasp of the clamp, which may happen in whole or in part – and is always awkward – as sufficient loosening of the clamp to enable the slipped out portion to be returned, naturally allows the rest to also escape – and the entire technic is ruined. Too much compression may so damage the margins as to result in failure of union. When all is in readiness, the portion of the scrotal sac distal to the clamp is severed by curved scissors or knife, traveling closely along the lower margin of the clamp (Fig. 5104). While the clamp is still *in situ*, interrupted catgut sutures are placed in the special manner shown in the illustration – carried by a Keith needle through the holes of the clamp, and tied in the slots leading from each hole to the free margin of



Fig. 5105.—Excision of Redundant Scrotum – under finger control; – The testicles are pressed upward toward the pubis by the palm and fingers of an Assistant's hand – between whose first and second fingers the excess of scrotum is drawn downward and compressed. A Reverdin needle is placing mattress-sutures to approximate the scrotal walls and to retain the testes within the sacs. Distally to these sutures scissors are excising the excess of scrotal sac – after which all bleeding vessels will be tied – and the resulting free edges of the divided scrotum will be united by ordinary suture, interrupted or continuous.

the clamp – and also to the free margin of the divided scrotum. The clamp is then moderately relaxed, and any vessel detected in the line of incision is clamped, drawn out a short way, and tied – and then pushed back between the stitches. The clamp is finally entirely removed – and the parts dressed – and rather firmly supported by a T-bandage.

Theoretically, this appears to be an ideal technic – but, practically, the Writer has often encountered hematomata on making the first dressing – which undoubtedly occurred from vessels which had been divided in making the section, but which retracted and became concealed by the clamp, and were never discovered, to be tied – so that the very instrument which has been used to prevent hemorrhage, indirectly invited it – or, at least, negatively

prepared the way for it, in that it hid the vessels which might have been readily tied in any open form of operation. Sometimes the suture line has to be opened up to control the bleeding _ and at others even if not to control the bleeding, to evacuate hematomata, which are sometimes infected _ involving the patient at times in a considerable convalescence rather than a speedy primary union. This is the only drawback to the technic. No additional suturing is required after the clamp is removed. No drain is, ordinarily, employed, but undoubtedly the majority of the cases which eventuated in hematoma would have had a happier course had a small temporary drain (rubber tube or twist of gauze) been inserted between two of the stitches.

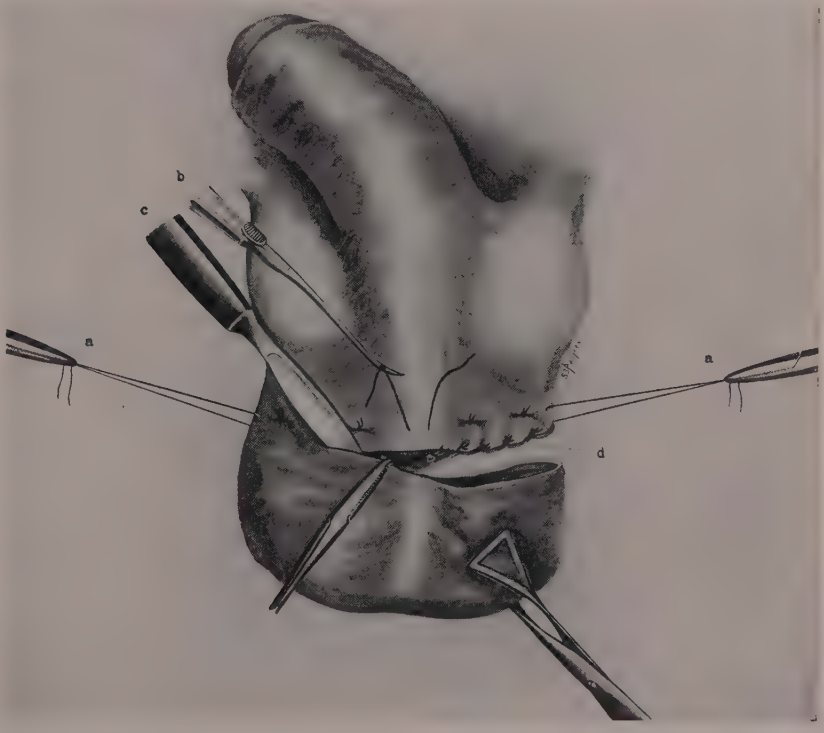


Fig. 5106.—Excision of Redundant Scrotum _ under suture control; _ Having displaced the testes upward, mattress-sutures, through the entire thickness of the scrotum, are placed just above the intended division of the scrotal sac, to retain the testes within the sac, by approximating the opposite walls of the scrotum: _ a, a, Two loop tractors at extreme lateral aspects of the scrotum; _ b, Reverdin needle in act of completing a mattress-stitch; _ c, knife excising the excess of scrotal tissue; _ d, sutures uniting the free edges of the scrotum. One of the scrotal vessels is seen ligated, and another clamped.

Excision of the Redundant Scrotum Under Finger Control.—The rôle of the clamp is here played by the fingers of the Assistant _ who, taking the scrotum between his first and second fingers, elevates the testicles out of harm's way by means of all of his fingers conjointly _ while, by lateral compression with the sides of the fingers between which the scrotal sac is drawn, he brings to bear sufficient pressure to largely control the blood-supply. Corresponding fingers of both hands may be used. When all is in readiness, a series of mattress-sutures are placed immediately below the supporting and compressing fingers by means of a Reverdin needle. These also partly control bleeding and entirely prevent the escape of the testes in the event the edges

of the divided scrotum slip through the fingers of the Assistant. When the tier of mattress-sutures have been placed and tied the scrotal sac is divided with curved scissors or a knife at a safe distance below and parallel with the tier of sutures (Fig. 5105). Search is made between the lips of the wound for bleeding vessels, and any encountered are clamped and tied. Here, too, the cut vessels may have escaped within the scrotum and give both present and subsequent trouble. The parts are dressed and supported as in the last technic.

Excision of the Redundant Scrotum Under Traction-suture Control.—Having digitally pushed the testicles into the upper part of the scrotum, and held the two lateral boundaries of the scrotum apart by means of stay sutures, a series of transversely placed mattress-sutures, carried by Reverdin needle, are thrown across the scrotum immediately above the level of intended

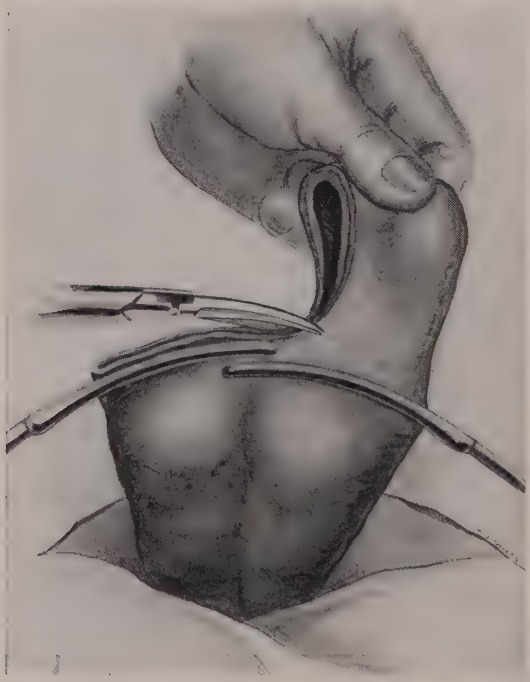


Fig. 5107.—Excision of Redundant Scrotum – aided by double clamp control and the vertical position.

section. When these have all been tied, and the tractors tense the parts, the scrotum is transversely divided safely below the line of mattress-sutures by knife (Fig. 5106) – or scissors. All bleeding vessels which can be detected are clamped and tied – in the manner shown in the last picture. Finally, the tractor sutures are withdrawn and the parts dressed and supported.

Excision of the Redundant Scrotum by Double Clamp Control.—This technic, while less spectacular than some of the others, is probably the best safeguard against postoperative hematomata from divided vessels which retract out of the way, and are not recognized at the time of operation. The scrotum is first inverted – that is, held with its normally lowest part, now highest – so that a bag is formed from which, even if cut open, the testicles will not escape, because its open part is highest. The testicles are now pushed *downward* – that is, toward the pubis, as the patient lies supine, and the

scrotum is held vertical. Two light long curved clamps are used _ each compressing one side of the scrotal sac and slightly overlapping in the middle. The redundant scrotum is then cut off with curved scissors just beyond, distal to, the crossed clamps (Fig. 5107). The special feature of the operation now appears. Each clamp may be relaxed in turn, and the margins of the sac seized with hemostats, while the interior of the wound is examined for bleeding vessels _ all of which are secured by ligature with fine catgut _ so that subsequent hematoma is much less likely than in the other forms of control. When all bleeding has ceased the margins of the scrotal wound are sutured with silkworm filament _ which, as there is but one tier of sutures in this technic, is safer. The parts are dressed and supported as in the other types of operation.

TOTAL EXCISION OF THE SCROTUM

Description.—The condition under which methodical excision of the entire scrotal sac, with preservation of the testes, has been most frequently performed is in lymph scrotum (filarial elephantiasis) _ and in the countries where this disease prevails, has been successfully carried out, in appropriate cases. One Indian Surgeon reports having removed "over a ton" of scrota! (quoted from Cabot). Considerable success has been reported in operating _ the principle of the operation being to cover over the regions left bare by the excision by means of the loosened skin in the neighborhood, which the weight of the tumor has dragged down into the vicinity _ in preparation for such usage, as it were.

Elephantiasis of non-filarial origin _ such as occurs in this country (elephantiasis nostras) is due to obstructive lesions involving the lymphatics and veins of the part _ such as may be connected with traumatism, scar formation, extensive gland removal, and infection.

A typical partial or more or less complete excision of the scrotum may be necessitated in extensive traumatisms of the parts.

Operation.—The details of the operation in the individual case will largely depend upon the local conditions and distribution in the specific instance _ the technic here described being an outline of general application.

A more or less shield-shaped or heart-shaped area is included in the incision through which the scrotal and adjacent skin is removed _ as shown in Fig. 5108. Beginning, in cases of moderate involvement, beneath the middle of the base of the penis at its junction with the scrotum, the incision passes at first upward and outward, and then downward, along the junction of the thigh with the perineum, as far outward upon the thigh as necessitated by the outline of the disease, to end in the median perineal raphé between the base of the scrotum and the anus. The same incision is duplicated upon the opposite side. The skin included within this outline is now dissected from its bed in the connective-tissue plane _ down to the bare testicles and perineal structures _ as seen in the last illustration. All bleeding vessels are tied with fine catgut. All involved lymphatics are removed. Lymphatic varices along the spermatic cords are excised, even laying open the inguinal canals to the internal rings by incising the external oblique muscles. The inguinal lymphatic glands are also to be removed if involved _ through lateral extensions from the main incision.

In completing the operation effort should be made to cover in the denuded area by means of the skin from the vicinity _ which is extensively mobilized by undercutting (Fig. 5108) for that purpose. The fact that the weight of the tumor has accustomed the neighboring skin to stretching is helpful to this end. If the adjacent skin cannot be brought entirely over the extensive

wound, in the ideal manner shown in Fig. 5109, then it should be made to cover the raw surfaces as far as possible _ and the remaining surface be covered by grafting _ or by some immediate or later form of plastic operation.

Comments.—A figure-of-eight tourniquet of rubber tubing is sometimes carried around the waist and the base of the scrotum for the control of hemorrhage _ but seems unnecessary.

The surrounding incisions should, of course, be placed well to the sound side of the line of involvement.

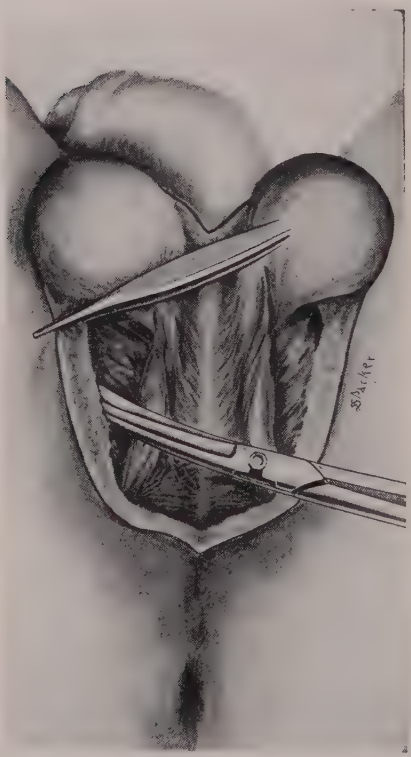


Fig. 5108.—Total Excision of the Scrotum, with Preservation of the Testicles _ I; _ Freeing the testicles and perineum of scrotal tissue and providing flap covering; _ A V-shaped incision passes in front of the base of the penis _ and is continued, in a shield-like figure, along the junction of the scrotum and thigh and scrotum and perineum. The entire area of included skin is removed, including that covering the testes. Scissors are undercutting the skin and connective tissue surrounding the wound sufficiently to cover-in the denuded area.



Fig. 5109.—The Same _ II; _ Suturing of the mobilized flaps _ forming new coverings for the testicles and perineum.

The penis may be involved, and if its skin must be removed, is at once replaced by grafts from the thighs.

Accompanying varicose veins are excised. If hydrocele accompanies, some form of radical operation is indicated.

In some instances it is indicated to also excise involved testicles _ together with amputation of the penis and the removal of the inguinal lymphatic glands.

CHAPTER LXXX

OPERATIONS UPON THE TESTICLES

Surgical anatomy of the testicles, p. 801.

Paracentesis tunicæ vaginalis testis, p. 802; _ Operations for hydrocele of the tunica vaginalis, in general, p. 807; _ Operation for hydrocele by excision of the parietal layer of the tunica vaginalis (von Bergmann), p. 808; _ Operation for hydrocele by incision and eversion of the tunica vaginalis (Jaboulay), p. 811; _ Operation for hydrocele by incision of the tunica vaginalis (Volkmann), p. 812; _ Operation by reefing the incised tunica vaginalis (Klapp), p. 813.

Operation for undescended or misplaced testicle, in general, p. 814; _ Bevan's operation for orchidopexy, p. 814; _ Doyen's method of orchidopexy, p. 818; _ Beck's method of orchidopexy, p. 820; _ Hahn's operation for orchidopexy, p. 821; _ Burghard's method of orchidopexy, p. 823; _ Orchidocelioplasty, p. 825.

Orchidotomy for exploration, followed by orchidorrhaphy, p. 825.

Orchidectomy, p. 827.

SURGICAL ANATOMY OF THE TESTICLES

Description.—The testes consist of the testicles proper and the epididymes, the latter also being the beginnings of the vasa deferentia. The proper coverings of the testicles are _ the tunicæ vaginalis, albuginea, and vasculosa. (The testes may also be said to be covered by the several tissues of the scrotum, v. p. 794.)

Tunica Vaginalis.—A closed serous sac originally derived from the peritoneum, surrounding the testicle with two layers: _ (*a*) Visceral Layer _ closely adherent to testicle proper, to globus major, to external part of body of epididymis, and to lower 1.3 cm. ($\frac{1}{2}$ inch) of spermatic cord. Nearly all of the globus minor and inner and back parts of epididymis are uncovered, and here the vascular communications exist between the testis and coverings. (*b*) Parietal Layer _ continuous with and reflected from the visceral layer at the posterior and inferior aspects of the testis and at the spermatic cord _ adherent to the inner surface of the infundibuliform fascia, to which it is attached by the prolongation from the subperitoneal areolar tissue _ and extends up upon the antero-internal aspect of the cord and below the testis. (*c*) Cavity of the tunica vaginalis _ interval between visceral and parietal layers.

Tunica Albuginea.—The dense, inelastic fibrous covering of the testicle _ reflected into the interior of the testicle at its posterior aspect to form an incomplete septum and trabeculæ, the mediastinum testis.

Tunica Vasculosa.—A layer formed by a plexus of vessels running in the areolar tissue. Lines the tunica albuginea and trabeculæ.

Lobuli Testis.—Consist of tubuli seminiferi, resting in the trabecular spaces _ forming the glandular structure of the testis.

Arteries.—Spermatic, of abdominal aorta (divides into branches which pierce the tunica albuginea at the back of gland).

Veins.—Spermatic (begin in testis _ leave it posteriorly _ and ascend cord, forming pampiniform plexus).

Lymphatics.—Follow spermatic vessels and empty into lumbar glands.

Nerves.—From aortic and hypogastric plexuses.

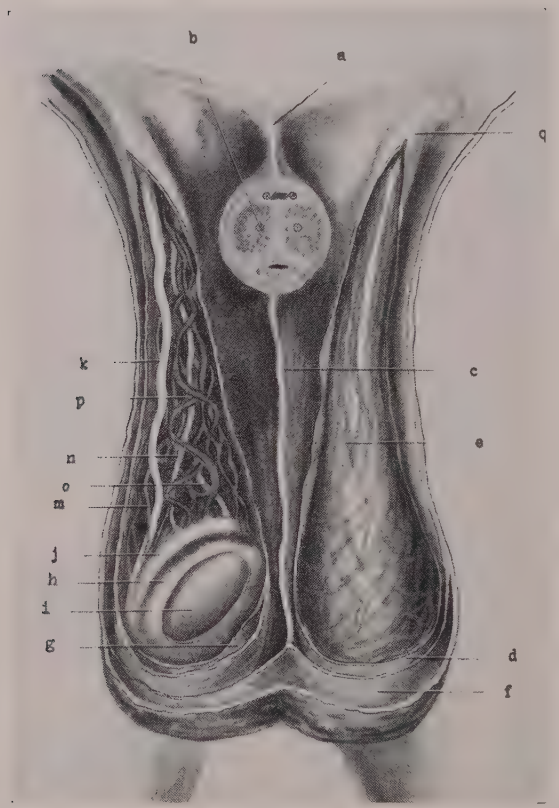


Fig. 5110.—Anatomy of the Male Organs in Section: – **a,** Suspensory ligament of the penis; – **b,** transverse section of the penis; – **c,** septum scroti; – **d,** cremaster fascia; – **e,** cremaster muscle; – **f,** tunica dartos; – **g,** tunica vaginalis communis; – **h,** tunica vaginalis propria (parietal layer); – **i,** tunica vaginalis propria (visceral layer of testis); – **j,** epididymis; – **k,** vas deferens; – **m,** artery of vas deferens (of superior vesical); – **n,** spermatic artery (of aorta); – **o,** cremasteric artery (of deep epigastric); – **p,** pampiniform plexus of veins; – **q,** spermatic cord. (Modified from Lehmann, Sobotta and McMurrich, and from Spalteholz.)

PARACENTESIS TUNICÆ VAGINALIS TESTIS

Description.—Puncture of the sac of the tunica vaginalis with a hollow needle or a trocar and cannula – either for the purpose of withdrawing fluid for examination, or for curative treatment – or for the purpose of injecting medicated fluid (after the withdrawal of the fluid already distending the sac). Exploratory puncture may be made under various pathologic conditions.

Simple puncture, or tapping, for the withdrawal of fluid, followed by compressing bandaging, as a curative measure by itself, is sometimes successful in hydrocele, especially in children.

Aspiration of the hydrocele fluid, with immediately following injection of some such medicated fluid as tincture of iodin or carbolic acid, into the hydrocele sac (tunica vaginalis), will often produce a cure where simple aspirations alone will fail – in an intermediate group of cases, ranking between the extreme class, on the one hand, in which aspiration and bandaging will cure, and another category of cases, at the opposite extreme, in which nothing will produce cure except radical operation.

Aspiration of a hydrocele sac without or with following injection of

some irritating fluid must be considered an intermediate grade of satisfactory measures in average cases of hydrocele.

Preparation.—The scrotum is shaved and disinfected. The penis is wrapped in gauze and held away from the field of operation.

Position.—The patient is supine, at the edge of the table. The Surgeon generally stands on the side of the patient (independently of the side of involvement) which will enable him to grasp the scrotum with his left hand.

Analgesia _ Anesthesia.—The former is usually employed in adults _ and the latter in children.

Landmarks.—The position of the testicle should have been estimated by manipulation and transillumination _ so as to avoid wounding its substance after piercing the tunica vaginalis.

Puncture of the Tunica Vaginalis, Followed by Exploratory or Evacuating Aspiration.—The scrotum is grasped posteriorly by the Surgeon's

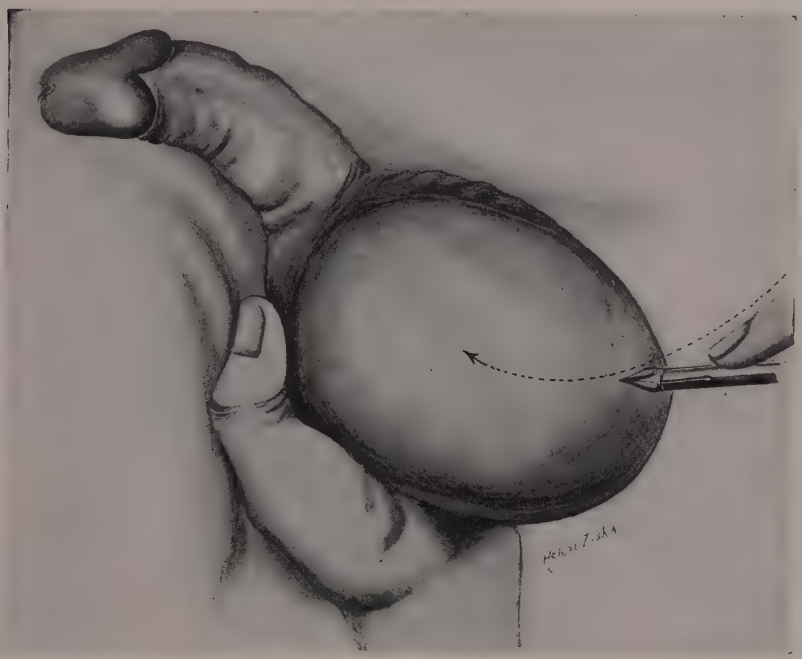


Fig. 5111.—Paracentesis of the Tunica vaginalis for Hydrocele; _ The instrument should be entered somewhat higher and more perpendicularly than here shown.

left hand in such a way as to render the anterior aspect of the tumor tense. The needle or trocar is so held, with the right index-finger near its point (Fig. 5111), as to fix the maximum depth to which it can enter. Thus, held guardedly, it is thrust sharply into the antero-inferior aspect of the sac at about the upper limit of its lower third, through some area devoid of visible vessels _ passing at first directly backward _ and then, after entering the cavity of the tunical vaginalis, upward, parallel with the anterior face of the testicle proper (Fig. 5112), so as to avoid wounding its substance. It is desirable that the puncturing point pass directly into the distended cavity of the sac _ and if fluid does not at once follow the withdrawal of the piston of the aspirator or the trocar, the likelihood is that complete puncture has not been made _ that the needle or cannula is in the connective-tissue plane _

calling for repuncture, or deeper puncture, either of which is unfortunate – as it is even more unfortunate to let the instrument slip out of the sac before the exhaustion of fluid is complete, for the hydrocele fluid is then almost sure to infiltrate the areolar tissue of the part. While evacuating the fluid the scrotum may be reasonably kneaded to aid in the complete emptying of the sac – and this may be done with greater freedom if a cannula be within the sac rather than the sharp point of an aspirating needle. In finally withdrawing the needle or cannula the instrument is grasped, through the scrotal wall, at the site at which it leaves the tunica vaginalis, and in its course to its exit from the skin, and compressed, and the parts rubbed together, in the



Fig. 5112.—Paracentesis of the Tunica Vaginalis – in sectional view.

rather rapid withdrawal, to avoid leakage from the sac into the areolar tissue. The skin opening is sealed with bichloridized collodion and sterile cotton. The scrotum is at once compressed by some form of dressing – such, for instance, as that advised by Cheetwood for a swollen testicle (Fig. 5113). The object of the compression is to aid in the prevention of the refilling of the sac. The technic is made more complete if the patient remain temporarily supine, with the strapped testicle supported by some such contrivance as shown in Fig. 5114.

One must endeavor to avoid wounding the testicle and the cord during the manipulations. The testicle proper usually lies posterior to a tunica vaginalis filled with hydrocele fluid – but sometimes lies below – and occasionally in front – being modified in position by adhesions which may have formed.



Fig. 5113.—Cheetwood's Method of Strapping the Swollen Testicle – with a turn or two of rubber bandage, held by one or more strips of rubber plaster. (A condition of orchitis or epididymitis is here represented rather than hydrocele.)

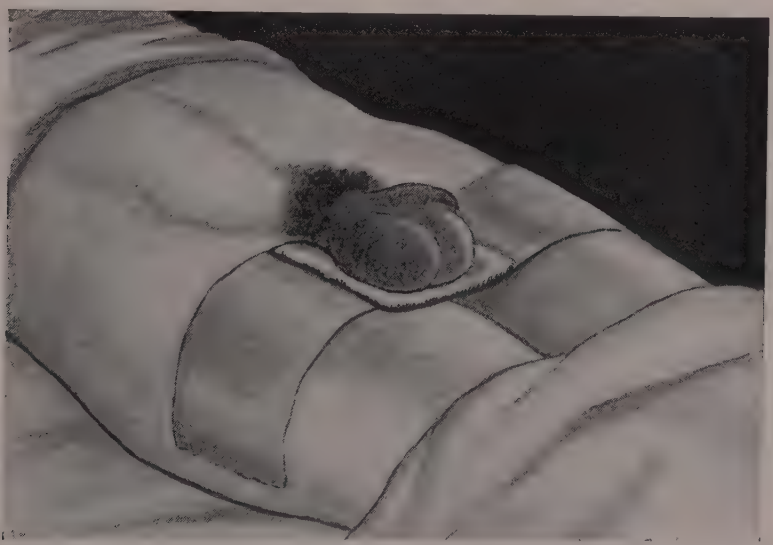


Fig. 5114.—Rubber Plaster Support Surmounted by Gauze Pad – for elevating scrotum during operations upon the testes and cords – (and also useful during treatment).

As far as possible its position should be determined in advance by digital examination, transillumination, etc.

In large hydroceles in old men some Surgeons prefer to first withdraw part

of the fluid — and the balance later — because of the fact that hemorrhage into the sac from following congestion has occurred. It would seem, however, if the proper precautions were taken as to the immediate postoperative compression of the part this might be avoided.

To summarize, simple aspiration is not likely to succeed except in simple, recent uncomplicated cases — as are most frequently encountered in the very young.

Puncture of the Tunica Vaginalis, Followed by Aspiration of the Hydrocele Fluid and the Injection of Some Irritating Agent to Obliterate the Sac.—This technic has been long in use — and is often successful in simple, uncomplicated cases, with clear fluid and recent unthickened wall — but is strictly contraindicated in any form of hydrocele which communicates with the peritoneal cavity or is complicated by hernia — or where associated disease of the testicle or epididymis exists — or in cases in which the wall of the sac is thick.

The technic, as to the puncture of the tunica vaginalis and up to and through the evacuation of the hydrocele fluid, is exactly the same as that just described under simple puncture and evacuation (p. 802).

The cauterant fluid formerly most frequently injected was the official tincture of iodin (2 drams). The agent at present generally employed is from 5 to 20 minims of pure carbolic acid, liquefied by heat (Cabot); — 2 c.c (30 minims) of 95 per cent. carbolic acid (Osgood); — or 50 minims of deliquesced carbolic acid crystals (Keyes) as being less painful and more efficient than iodin.

A special feature of the treatment by injection is the complete emptying of the tunica vaginalis of *all* of its hydrocele fluid *before* injecting the agent into it — so that it will act upon the walls of the sac in its full strength and not be largely lost in its efficiency by admixture with more or less non-evacuated residual fluid To this end the technic usually advised is to first introduce a hypodermic needle, detached from the barrel of the syringe, into the upper anterior aspect of the hydrocele sac, and, as soon as a small escape of fluid demonstrates that the needle is in the sac, to plug the outer end of the needle and leave it *in situ* — being careful to see that it is not subsequently drawn out of the sac, with its point left among the outlying tissues. A trocar and cannula of fairly small caliber (so as not to make a large enough opening in the sac for extensive outward escape of the injected agent) are then carried into the lower anterior aspect of the sac — through which, on the withdrawal of the trocar, the sac is thoroughly emptied of all the fluid which can be drained and pressed from it through the cannula. The cannula is then withdrawn — its opening into the sac being helped to mechanically close by rubbing the surfaces together, and its skin opening being sealed with bichloridized collodion. The plug is now withdrawn from the hypodermic needle left *in situ* — the barrel of the syringe is screwed to the needle, which is most carefully held in position — and the carbolic acid is injected into the sac — the needle withdrawn — and the walls of the sac rubbed and kneaded well together so as to evenly distribute the agent over the entire surfaces of the sac. Following this procedure — even more than after simple aspiration — should the patient be temporarily confined to his back with the scrotum supported (v. p. 805). Local reaction may be met by cold or hot applications.

The sac is often emptied and injected through the same needle. A still better technic is the one sometimes carried out — in which a triple type of instrument is employed, — a fine trocar and cannula are introduced, the trocar withdrawn, the fluid evacuated through the cannula — and then the barrel of a fitted syringe screwed onto the cannula, and its contained fluid injected.

OPERATIONS FOR HYDROCELE OF THE TUNICA VAGINALIS, IN GENERAL

Description.—In acquired hydrocele there is an excessive accumulation within the tunica vaginalis testis of the natural fluid of the part derived from the tunica vaginalis itself. In congenital hydrocele the fluid does not have its origin within the tunica vaginalis, but simply flows into it from the communicating peritoneal cavity.

Varieties of Hydrocele.—(*a*) Hydrocele of the tunica vaginalis (Fig. 5115) – the fluid is here confined within the cavity of the tunca vaginalis; – (*b*) Hydrocele of the cord (Fig. 5116) – in which there is an accumulation of fluid within the unobliterated processus vaginalis, communicating with the peritoneal cavity; – (*c*) Encysted Hydrocele of the cord (Fig. 5117) – in which the processus vaginalis is unobliterated and contains fluid – the fluid,



Fig. 5115.—Hydrocele of Tunica Vaginalis Testis.



Fig. 5116.—Hydrocele of the Cord – communicating, by an unclosed peritoneal process, with the peritoneal cavity.

however, not communicating either with the tunica vaginalis below or with the peritoneal cavity above; – (*d*) Congenital Hydrocele (Fig. 5118) – in which the hydrocele of the tunica vaginalis communicates with the peritoneal cavity (the opening between the two, as extremes, being either so small that but little fluid enters, or large enough for hernia of the intestines); – (*e*) Infantile Hydrocele – in which the processus vaginalis is obliterated only at its upper end, so that the rest of the tunica vaginalis fills with fluid, which, however, does not communicate with the peritoneal cavity; – (*f*) Hydrocele of the sac of a hernia – where the accumulation takes place into an empty hernial sac (from which the hernia has been reduced); – (*g*) Inguinal Hydrocele – in which hydrocele is present in conjunction with a testicle retained in the inguinal canal (undescended); – (*h*) Bilocular Hydrocele – in which hydrocele of the tunica vaginalis and hydrocele of the cord coexist; – (*i*) Multilocular Hydrocele –

where the hydrocele cavity is partitioned into a number of compartments. Further – hydrocele may be acute or chronic – symptomatic or idiopathic.

Methods of Treatment.—Operative methods for the relief of hydrocele may be grouped under three headings: – (*a*) Tapping or aspiration – which is rarely other than palliative; – (*b*) Injection of various fluids – whose object is to cause obliteration of the serous or fluid secreting surfaces; – (*c*) Radical operations – which remove, obliterate, or so modify the secreting surfaces



Fig. 5117.—Encysted Hydrocele of the Cord.

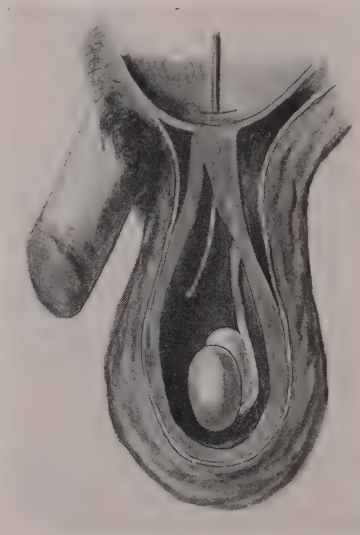


Fig. 5118.—Congenital Hydrocele.

that fluid no longer accumulates – and which constitute the best method of procedure available.

OPERATION FOR HYDROCELE OF THE TUNICA VAGINALIS BY EXCISION OF ITS PARIETAL LAYER

VON BERGMANN'S TECHNIC

Description.—This method consists in the excision of the parietal layer of the tunica vaginalis, followed by closure of the scrotal sac, with temporary drainage – and may be regarded as the most radical and best method of treating cases of hydrocele – especially where the wall of the tunica vaginalis is very much thickened, or which have resisted other methods of treatment, or are inappropriate for other methods – and, as well, where one does not want to consume the time involved in the trial of other less certain measures. Besides excising the parietal layer of the tunica vaginalis, some Operators wipe the visceral layer over with carbolic acid, so as to destroy its secreting surface.

Preparation – Position – Landmarks.—As in Paracentesis of the Sac (p. 802).

Operation.—The freeing of the parietal layer of the tunica vaginalis and its excision, as far as it is possible to accomplish this, is made easier if incision of the tunic be carefully avoided until after its parietal layer has been entirely

separated from the overlying scrotal layers. To this end, after holding the scrotum so as to tense its surface, an incision is made over the anterior or anteroexternal aspect of the scrotum, calculated to be of sufficient length to admit of the delivery of the testicle through it – averaging, approximately, 7.5 to 10 cm. (3–5 inches) in length. Instead of making a plunge cut directly into the tunica vaginalis, the incision is carefully made, the full length of the cut at each stroke, through each layer of the scrotum – skin, fascia, dartos, intercolumnar fascia (external spermatic fascia), cremasteric fascia (middle spermatic fascia), infundibuliform fascia (fascia propria or internal spermatic fascia) – down to but not into the tunica vaginalis – not that each one of these layers will be recognized – but at least the tunica vaginalis should be

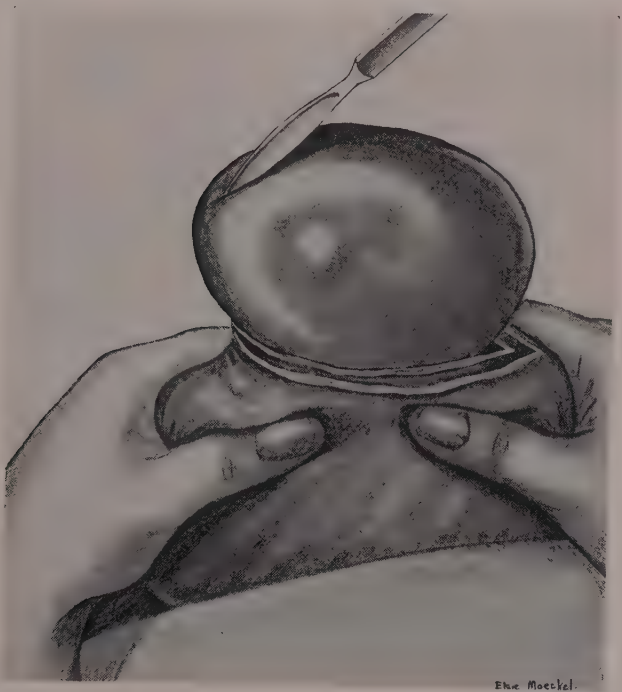


Fig. 5119.—Operation for Hydrocele of the Tunica Vaginalis by Excision of its Parietal Layer – Von Bergmann – I; – The distended tunica vaginalis has been freed of its overlying scrotal tissues and has been delivered outside of the scrotal sac. Its wall is being incised preparatorily to splitting it axially – preparatorily, in turn, to excising its parietal layer.

known when it is reached, and its division avoided. As soon as the tunica vaginalis is reached throughout the length of the wound by combined retraction of the margins of the scrotal wound, and blunt and sharp dissection of the overlying tissues from the tunica vaginalis, the distended tunica vaginalis is eventually virtually squeezed and dissected out of its scrotal bed (Fig. 5119) – and freed up to the reflection of the partial layer of the tunica onto the testicle itself to form the visceral layer – and this procedure is very much easier as long as the vaginal tunic remains uncut. The distended tunical sac of the hydrocele, delivered from the scrotal sac, is finally incised – and the parietal layer of the tunica vaginalis is seized with forceps and cut off all around, right up to its reflection onto the testicle and the epididymis – care to avoid wounding the globus minor being especially taken. The general appearance

of the testicle with its parietal layer removed is as seen in Fig. 5120. Bleeding may be somewhat annoying during the freeing of the overlying parts from the tunica vaginalis. Visible vessels should be tied with fine catgut. Extensive oozing may be checked by pressure with pledgets of gauze dipped in adrenalin solution and held in hemostats. Prior to concluding the operation the visceral layer of the tunica vaginalis is washed over, by some, with carbolic acid to render less possible the reaccumulation of fluid. In concluding the operation the testicle is returned to the scrotal sac, a small rubber tube is introduced as a temporary drain, and anchored in the lips of the wound, and the rest of the scrotal wound closed by interrupted sutures. The scrotum is dressed with reasonable compression and kept supported.

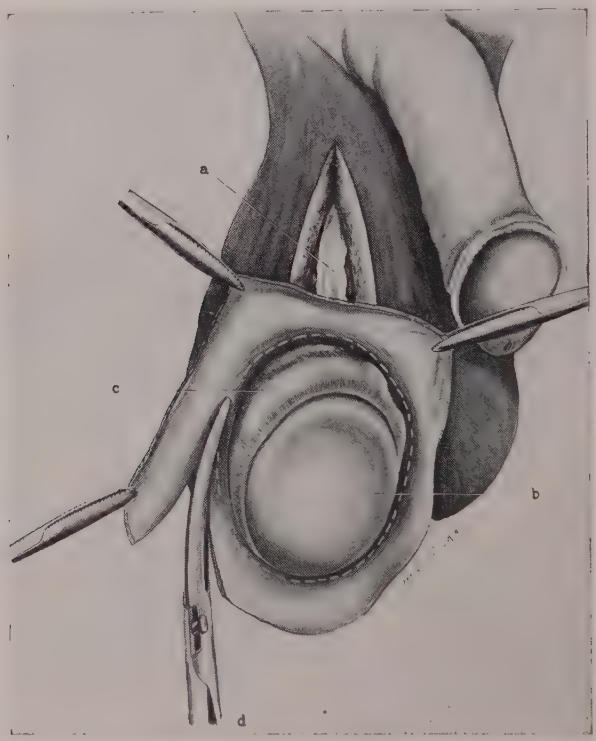


Fig. 5120.—Operation for Hydrocele by Excision of the Tunica Vaginalis – von Bergmann: – a, Cord; – b, testis; – c, globus major; – d, excision of the tunica vaginalis, which has been first incised.

A less desirable manner of procedure is the following: – Instead of first freeing the distended tunica vaginalis in the connective-tissue plane, before incising it, it is incised at once, as soon as reached at the bottom of the original incision. The tunica vaginalis is then incised in the same line, at first to the extent of about 1.3 cm. ($\frac{1}{2}$ inch). Through this opening the finger is introduced and the cavity of the tunica vaginalis and the position of the testicle examined. The collapsed tunica vaginalis is then incised to the full extent of the external wound with scissors. All bleeding vessels are clamped and tied. The parietal layer of the tunica vaginalis is seized and partly peeled, partly dissected away from the scrotum, by fingers and forceps – nearly up to the epididymis externally – and nearly up to the testicle internally – along which lines it is cut away

with scissors. Bleeding from this step, which is much greater by this technic, is controlled by pressure, hot douching, and gut ligature. A drainage-tube is then usually inserted into the cavity and the lips of the scrotal wound closed by suturing up to the drainage-tube.

OPERATION FOR HYDROCELE BY INCISION AND EVERSION OF THE TUNICA VAGINALIS

JABOULAY'S TECHNIC

Description.—The distended tunica vaginalis, along with the testicle, is delivered outside of the scrotal incision – after which the tunica vaginalis is incised, folded back upon itself, and its margins sutured together behind the testis and the cord. This technic is considered inferior to the method of excising the parietal layer of the vaginal tunic – as the area of secreting sur-

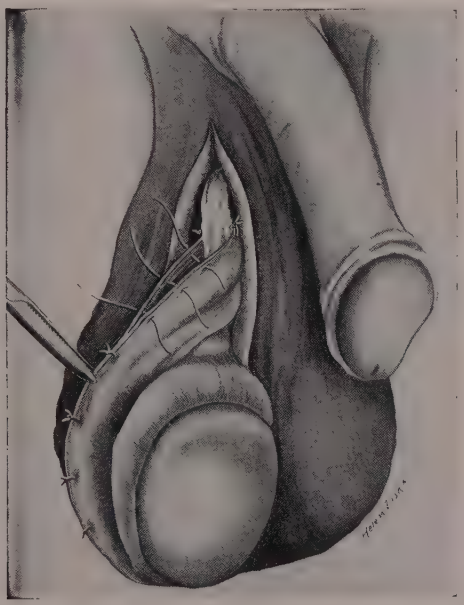


Fig. 5121.—Operation for Hydrocele by Eversion of the Incised Tunica Vaginalis – Jaboulay; – The tunica is incised, everted (turning the serosa outward), and its margins sutured together behind the testicle and cord – one or two stitches anchoring it to the cord itself.

face is not decreased, though displaced. Recurrences are reported – and the cord has been constricted – and when the hydrocele has thickened walls the technic is not so readily carried out. The operation is almost as extensive as von Bergmann's without being as satisfactory.

Preparation – Position – Landmarks – Incision.—As in the operation by excision of the parietal tunica vaginalis (v. p. 808).

Operation.—The operative procedure is exactly the same as in von Bergmann's technic (v. p. 808) in so far as the freeing of the distended tunica vaginalis of the overlying scrotal layers, and its delivery through the scrotal wound, prior to incising the sac. The sac of the hydrocele is then incised entirely down its anterior aspect – after which the testicle is pressed forward out through the slit in the now collapsed tunica vaginalis. The walls of the tunica are then everted and sutured together behind the testicle and the

cord (Fig. 5121) _ in such a manner as to bring the serous surface of the tunica vaginalis everywhere into contact with the tunica dartos. The testicle and everted tunica vaginalis are then carefully replaced within the scrotum _ being careful to see that the eversion is not unrolled in the act of replacement _ that the cord has not been axially twisted (which has resulted in strangulation) _ and that the sac has not been tightly enough sutured around the cord to constrict it. The scrotal wound is then sutured _ usually with temporary drainage instituted. The after-treatment is the same as in the last operation described.

Operation for Hydrocele by Partial Excision and Eversion of the Tunica Vaginalis (Winkelmann).—This procedure differs from the above only in the excision of the redundant portion of the sac of the tunica vaginalis (the excess being trimmed away with scissors) before suturing its margins together behind the testicle and cord. Calculation must be made, however, that sufficient tunica vaginalis is left to meet behind the testis and cord without danger of constricting them too much.

OPERATION FOR HYDROCELE BY INCISION OF THE TUNICA VAGINALIS

VOLKMANN'S TECHNIC

Description.—The tunica vaginalis is incised vertically in its anterior aspect and stitched to the scrotal skin _ its cavity being then wiped with



Fig. 5122.—Volkmann's Operation for Hydrocele: _ A, Lip of scrotal wound; _ B, tunica vaginalis incised; _ C, testis; _ D, suture passing through tunica vaginalis and entire thickness of lip of scrotal wound.

carbolic acid, packed with gauze, and allowed to heal by granulation. This method is now much less frequently performed than formerly _ owing to the fact that convalescence is very tedious, and often painful in dressings, and because serous pockets sometimes form in unobliterated tracts.

Operation.—The Assistant so grasps the tumor as to render tense and prominent its anterior aspect _ and at the same time keeps the testicle out of the way of injury. An incision of about 5 cm. (2 inches) in extent is made

along the antero-inferior aspect of the tumor – passing through the tissues overlying the tunica vaginalis (skin, dartos, intercolumnar fascia, cremasteric fascia, and infundibuliform fascia) through the tunica vaginalis and into its cavity. After the escape of the hydrocele fluid the edges of the tunica vaginalis are sutured to the edges of the scrotal skin by from four to eight chromic gut sutures – and the cavity itself of the tunica vaginalis is packed with gauze after being wiped with carbolic acid – and heals by granulation, thus obliterating the cavity. The scrotum is well supported and compressed by the dressing (Fig. 5122).

OPERATION FOR HYDROCELE BY REEFING THE INCISED TUNICA VAGINALIS

KLAPP'S TECHNIC

This particular method of procedure differs from that of Jaboulay's technic of eversion (v. p. 811) only in the feature that, after splitting the tunica

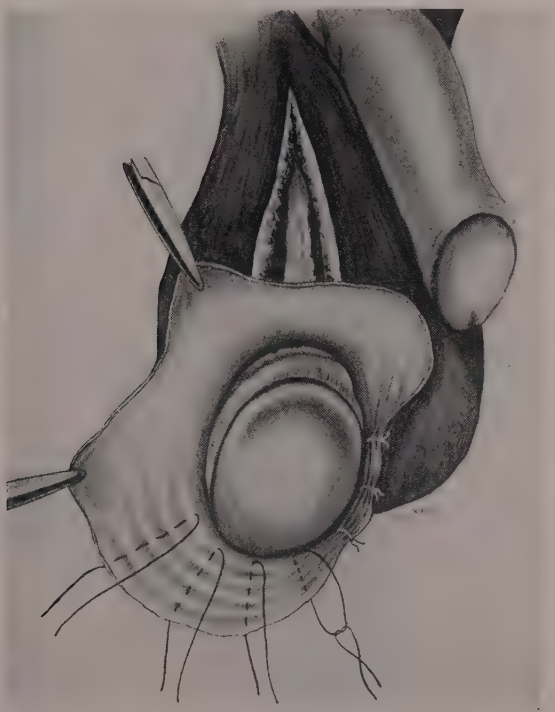


Fig. 5123.—Operation for Hydrocele by Reefing the Incised Tunica Vaginalis – Klapp; – Upon one side of the testis sutures are in the act of pleating the incised tunica vaginalis – upon the other the pleats have been drawn together and the sutures tied.

vaginalis, instead of everting the incised tunica vaginalis and suturing its margins behind the testicle and cord, the split tunic is simply reefed in parallel folds on each side of the testis – so that its serous surfaces are folded upon themselves in a series of pleats thereby causing adhesions between these secreting surfaces – as indicated in Fig. 5123.

The method of procedure as to the exposure of the parts is the same as in Jaboulay's operation – with the substitution of the reefing for the eversion.

OPERATIONS FOR UNDESCENDED OR MISPLACED TESTICLE, IN GENERAL

Instead of descending into its normal position within the scrotum the testicle may be arrested in its descent to the bottom of the scrotum in various positions: – within the abdomen, in the iliac fossa – near the iliac spine within the abdomen, at the internal ring – within the inguinal canal – external to the external abdominal ring, in some position between this site and its normal position – or its position may shift from one to another of these positions.

In other instances the testicle may be misplaced – and is then usually found in one of the following positions: – in the perineum (the commonest form) – in Scarpa's triangle (cruroscrotal or scrotofemoral) – penile (in the soft tissues lying between the pubes and the root of the penis) – interstitial (in front of the aponeurosis of the external oblique) – transverse (where both testes are in the same inguinal canal).

The conditions which are apt to result from unrelieved undescended testicle are the following: – loss of function of the gland; liability to injury, to torsion, and to tumor formation; proclivity to hernia.

The age at which operation is best undertaken is variously estimated, by different Surgeons, as between three and twelve years – with the majority probably agreeing upon the eighth or ninth year.

Methods of operating are usually grouped under three heads: – orchidectomy – permanent anchorage of the testicle within the abdomen – or orchidopexy (anchorage of the testis within the scrotum).

Orchidectomy, or castration, is now no longer considered – except in cases of associated tumor formation or in the presence of disorganizing injury.

Anchorage of the testicle within the abdomen has called forth contradictory expressions of opinion – the preponderance of which is to the effect that intra-abdominal testicles eventually cease to functionate – although Burghard states this to be erroneous, and backs up his statement by quoting that 5 adult undescended testicles examined had yielded large numbers of active spermatozoa. At the same time it is recognized by Burghard (and definitely advanced as an argument against intro-abdominal fixation), in any case in which orchidopexy can be performed, that it is most awkward to deal with some of the natural pathologic involvements of the testis implanted within the abdomen such as may result from gonorrhora and the like.

Orchidopexy, or anchorage of the testis in the scrotal sac, by one method or another, is the operation of choice in every case of undescended testicle to which its technic is applicable. Several varieties of this procedure will be here considered.

BEVAN'S OPERATION FOR ORCHIDOPEXY

Description.—The characteristic feature of this procedure is, following the freeing and delivery of the testicle, the construction of a tunica vaginalis for the testicle out of the peritoneal sac – after which the thus surrounded testicle is anchored in a pouch made for it within the scrotal sac.

Preparation.—The pubic and scrotal regions are shaved and disinfected – and the bladder and bowels are emptied.

Position.—Patient supine, near the edge of that side of the table corresponding with the involved side.

Landmarks.—Internal and external abdominal rings; inguinal canal; Poupart's ligament; anterior superior iliac spine; – position of the testis.

Anesthesia – Analgesia.—The former is practically always used – owing to the necessary compression and traction upon the structures of the testicle and cord.

Incision _ Operation.—The early part of the operation largely resembles the technic employed in the exposure of the parts in oblique inguinal hernia.

The incision begins at a point to the inner side of the anterosuperior iliac spine, and about 1.3 cm. ($\frac{1}{2}$ inch) above Poupart's ligament _ and passes obliquely downward over the inguinal canal, parallel with Poupart's ligament _ over the external abdominal ring _ and but a slight distance, if at all, below it.

This incision divides the skin, superficial fascia, and splits, in their cleavage line, the aponeurotic and muscular portions of the external oblique, thus exposing the inguinal canal. Beneath these incised structures lie the thin layers of the cremaster muscle and fascia, which are in turn cut _ after which is encountered the peritoneal pouch enclosing the undescended testicle. This is the vaginal process of the peritoneum, generally communicating, proximally, with the peritoneal cavity _ and sometimes reaches to the bottom of the scrotum, even

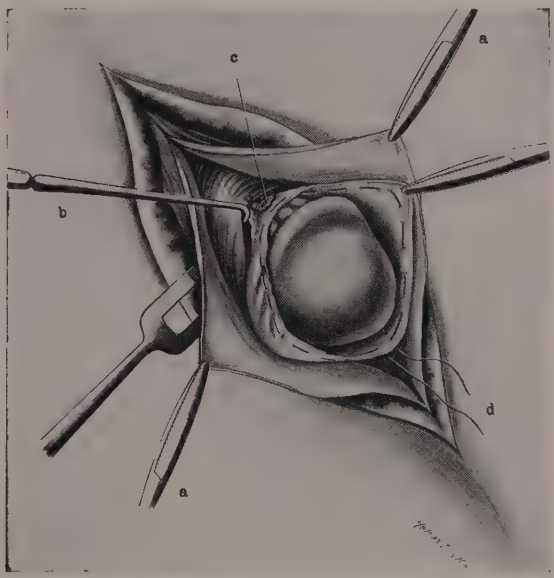


Fig. 5124.—Orchidopexy for Undescended Testicle _ Bevan _ I; _ The testicle is exposed as in the radical operation for oblique inguinal hernia: _ a, a, Divided external oblique muscle; _ b, retracted internal oblique muscle; _ c, vaginal process of the peritoneum, freed as high as possible and ligated above the cord; _ d, lower aspect of the processus vaginalis ready to be closed by purse-string suture, to form a tunica vaginalis for the testis.

though the testis may still be within the abdomen. The vaginal process of the peritoneum is now transversely divided well above the level of the testicle _ and with care that neither the structures of the cord nor other possible contents of the sac may be injured. If a coil of intestine or omentum be found within the sac it or they are returned to the peritoneal cavity. All manipulative procedures must be made with greatest care in young children, as the structures and especially the very thin peritoneum are easily torn. The upper divided end of the vaginal process of the peritoneal sac is closed by being seized with forceps (being sure that no intestine within is included), and is then freed, by blunt dissection, from the cord toward the abdominal cavity, and is finally ligated with chromic catgut (just as in hernia operation) as near to the internal abdominal ring as possible (Fig. 5124, c). Into the margins of the lower opening of the transversely divided processus vaginalis of the peritoneal

pouch a chromic catgut purse-string suture is inserted (v. Fig. 5124, **d**) _ which when drawn taut forms a sac or artificial tunica vaginalis around the undescended testicle (Fig. 5125, **f**). This artificial testicular sac is, however, usually firmly adherent to the structures of the cord, and is best separated from the cord by means of several layers of dry gauze held over the index-finger, with which the blunt dissection is carried on by a process of wiping, as it were _ which will enable the cord to be lengthened out until the undescended testicle can be brought down to considerable length. If this separation be interfered with by bands of fibrous connections in the cord structures these are either torn apart by blunt dissection or cut by careful snips of Mayo scissors _ until finally the vas deferens and vessels, on the one hand, are separated from the peritoneum, on the other.

In those cases in which the cord has been sufficiently lengthened out, and where a natural but empty peritoneal pouch extends to the bottom of the

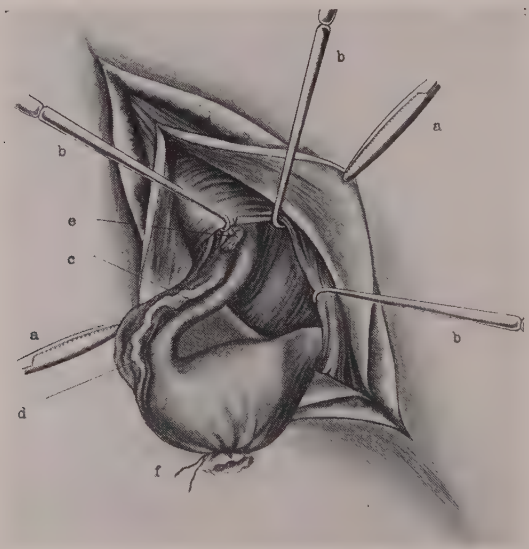


Fig. 5125.—The Same _ II: _ **a, a,** External oblique muscle; _ **b, b, b,** internal oblique muscle; _ **d,** vas deferens; _ **c,** vessels of the cord; _ **e,** ligated and divided vaginal process of the peritoneum; _ **f,** lower aspect of the vaginal process of the peritoneum closed to form a tunica vaginalis for the testicle.

scrotal sac, nothing remains but to protrude the mobilized testicle into the scrotal sac, and hold it there by a chromic catgut purse-string suture placed within the neck of the scrotal sac.

In those cases where the cord is long enough, but no natural scrotal sac, though empty, be present, one is tunneled into the scrotal tissues by blunt dissection with a finger or by pushing in two fingers and separating them.

In still other cases where it is found, even after mobilization, that the cord is not long enough to allow the testicle to reach the lower part of the scrotum _ being prevented, it is known, by the shortness of the spermatic artery and veins _ these vascular structures are divided between two catgut sutures without injury to the vas _ which will then enable the testicle to reach the bottom of the scrotum (Fig. 5125). The artery and veins of the vas will sufficiently supply the testicle _ after the ligation of the spermatic artery and the anterior set of veins.

In closing the inguinal wound, the cord is not transplanted, but remains

in its usual bed. The cord is generally anchored by a special suture of chromic catgut, which also includes the opposite fibrous margins of the split external oblique (Fig. 5126).

Comments.—All traction upon the cord must be of the gentlest sort—and no undue compression of the testicle must be used.

The success of the operation largely depends upon accomplishing such a degree of freeing of the testicle and cord that they will reach the bottom of the scrotum without tension.

The restraining purse-string suture placed in the neck of the scrotum to aid in retaining the testicle within the scrotum passes through the fascia of the

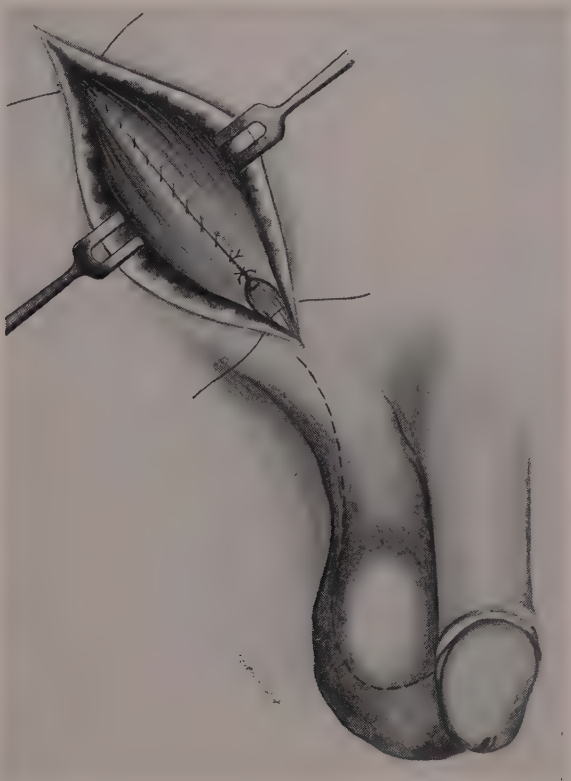


Fig. 5126.—The Same—IV;—The testicle has been brought down into the scrotum, as indicated by the dotted lines. The cord is anchored by a suture through the lower margins of the external oblique—whose split lips are united by continuous suture.

scrotum and the external and internal pillars of the inguinal ring. Finally the conjoint tendon is sutured to Poupart's ligament anterior to the cord.

The usage of the processus vaginalis, out of which to make a new tunica vaginalis, is occasionally followed subsequently by hydrocele. Bevan successfully met this in one of his cases by the intravascular injection of carbolic acid.

Any accompanying inguinal hernia is cured at the same operation.

Cutting of even the spermatic vessels is to be avoided where possible—as atrophy of the testicle has been reported where section of these particular vessels has been made.

Mobilization at the internal abdominal ring and just within the abdomen of the vas (passing downward and inward) and the vessels (passing upward and inward) considerably aids in lengthening these structures.

In addition to the purse-string at the scrotal neck, a double suture is passed from within outward, through the scrotal sac, after penetrating the new tunica vaginalis of the testicle. The ends may be tied over a gauze pedget lying upon the surface of the scrotum, or the ends are sometimes steadied against the thigh by strips of zinc oxid plaster _ the thigh, in turn, being immobilized by a splint.

The operations for misplaced testicle, either in the perineum or upon the thigh, are conducted upon practically the same principles; and are usually simpler than when the testicle is in some part of the inguinal canal or within the abdomen.

DOYEN'S METHOD OF ORCHIDOPEXY

Description.—The method of retaining the cord and testicle in their new position is twofold _ by suture anchorage of the cord to the boundaries of the

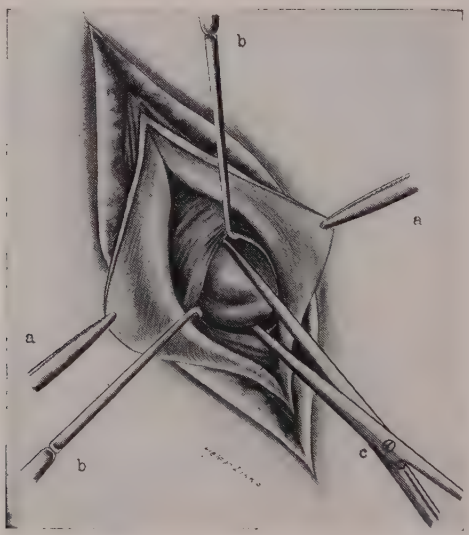


Fig. 5127.—Orchidopexy _ Doyen _ I; _ Delivery of an Undescended Testicle from the Inguinal Canal: _ a, a, External oblique; _ b, b, internal oblique displaced by traction; _ c, forceps delivering the testicle.

inguinal canal and to the margins of the external abdominal ring _ and by anchorage of the bottom of the testicle to the bottom of the scrotal pouch by a suture tied upon the scrotal skin.

Preparation _ Position _ Landmarks _ Anesthesia.—As in Bevan's operation (p. 814).

Incision.—As for oblique inguinal hernia _ over the inguinal canal.

Operation.—Having exposed the inguinal canal, the processus vaginalis is incised and the testicle sought and delivered (Fig. 5127).

If an accompanying hernia be present, the intestine is returned to the abdominal cavity _ the testicle and cord are freed of their peripheral fibrous adhesions, and the cord brought by this means and by gentle traction to the necessary length _ after which the internal abdominal ring is closed.

If no accompanying hernia be present, the processus vaginalis is incised similarly preliminarily to freeing and sufficiently lengthening the cord _ which is accomplished by blunt dissection, partly with dry gauze, aided, where necessary, with careful snips of scissors and by gentle traction. When sufficient length of cord is secured to reach the bottom of the scrotum the internal abdominal ring is first reconstructed _ and in the suturing of the cremaster muscle to the internal oblique, in the restoration of the inguinal canal, the fibrous tissues of the cord structures are included in the marginal stitches of chromic catgut (Fig. 5128). The special technic counted upon to prevent the subsequent ascension of the testicle is the suturing, at the extenal orifice of the inguinal canal, of the fibrous structures of the spermatic cord to the

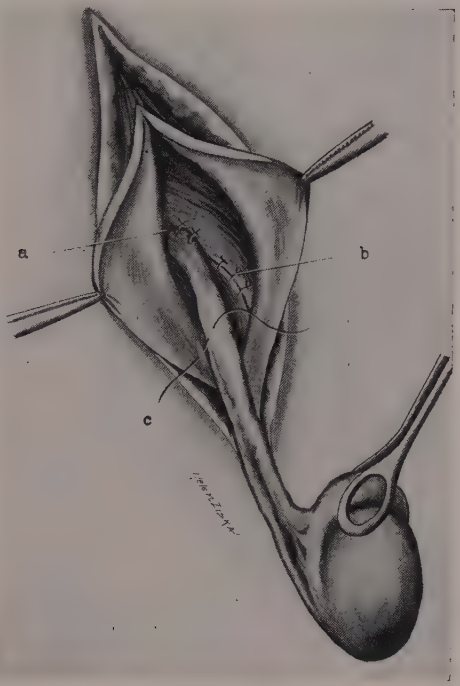


Fig. 5128.—The Same _ II; _ ANCHORAGE OF THE CORD OF AN UNDESCENDED TESTICLE DELIVERED FROM THE INGUINAL CANAL: _ a, Sutures of the cord to the margin of the inguinal canal; _ b, sutures of the cremaster muscle to the internal oblique; _ c, anchorage of the fibrous tunic of the cord.

periosteum of the pectineal crest and to the fibrous tissues in the vicinity of the pubic spine (v. Fig. 5128). The cord is thus anchored in the course of the inguinal canal, and at its outlet in the boundaries of the external abdominal ring. The opening by which the inguinal canal was exposed is now closed as in the ordinary operation for hernia.

A pocket within the scrotum is now made by finger tunneling (Fig. 5129). Into this the testicle is carefully pushed, without twisting the structures of the cord _ and after passing a silk suture through the more resistant tissues of the lower part of the testicle _ and passing the two limbs of this suture through the bottom of the scrotum, to be subsequently tied upon the cutaneous aspect of the scrotum.



Fig. 5129.—The Same — III; — Digital Dissection of the Scrotum to Make a Pouch for the Undescended Testicle.

BECK'S OPERATION FOR ORCHIDOPEXY

Description.—The special feature of this procedure is that after freeing the testicle and lengthening the cord, and placing the testicle within the scrotal pouch formed for it, a band of musculo-aponeurotic tissue, cut from the lower margin of the canal split roof of the inguinal is raised, turned transversely over the cord and united to the conjoint tendon, to prevent the testicle from being drawn back into the inguinal canal.

Preparation — Position — Landmarks — Anesthesia — Incision.—As in the preceding operation — and as though for the repair of inguinal hernia.

Operation.—The technical details of the procedure are the same as those in Orchidopexy, in General — up to the delivery of the testicle.

In those cases in which no difficulty is experienced in making the testicle reach its new scrotal bed, all goes well — but the technic has been criticized for the inadequate making of provision for sufficiently lengthening the cord in those cases where lengthening is needed — and also for the method of restraint of the testicle by the musculo-aponeurotic band in such a position that it may retract up to the upper aspect of the scrotum — as well as for the unnecessary sacrifice of any of the important external oblique aponeurosis in this important site.

The musculo-aponeurotic flap, or band, with pedicle at its lower end, is taken from the anterior aspect of the outer side of the split roof of the inguinal canal — consisting of the external oblique, cremaster, and transversalis muscles. The flap is bent downward and turned transversely across the cord,

just above the testicle – and its raw surface is sutured to the aponeurotic portion of the external oblique, upon the opposite side (Fig. 5130), where the ordinary suturing is shown, but where mattress-sutures would probably be better.

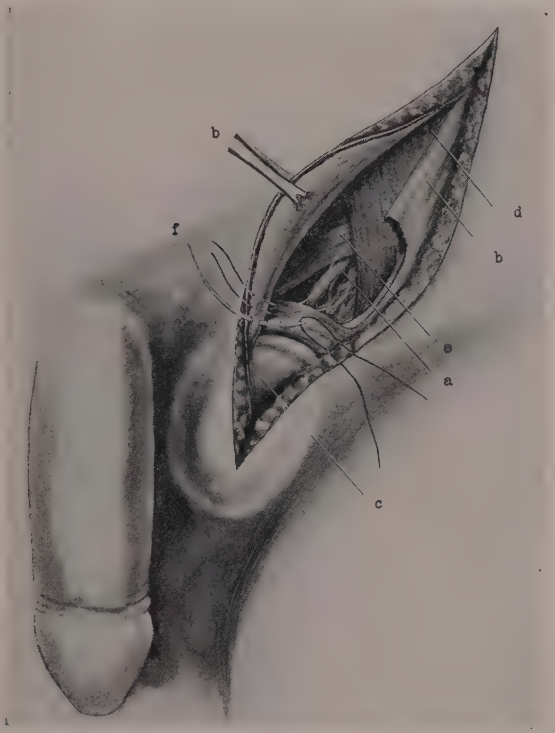


Fig. 5130.—Scrotal Orchidopexy for Undescended Testicle – Beck; – The testicle has been drawn from the inguinal canal and deposited in an artificially made pocket in the scrotum as low down as the length of the cord will allow. A band-like piece of the external oblique and cremaster, together with fascia of the internal oblique and transversalis, is partly detached and carried over the cord, proximal to the testicle and sutured to the conjoint tendon (out of sight, here), and to the under surface of the upper split portion of the external oblique, as a retention collar, f. c, Testis; – a, cord; – b, b, external oblique; – d, internal oblique; – e, transversalis. (Modified from Watson and Cunningham.)

It is upon the collar-like grip of this band that the dependence is placed to prevent the return of the testicle into the inguinal canal.

HAHN'S OPERATION FOR ORCHIDOPEXY

Description.—The feature of this method consists in the temporary anchorage of the testicle outside of the bottom of the scrotum – after which the adjacent skin is mobilized and sutured over it.

Preparation – Position – Landmarks – Anesthesia – Incision.—As in operations for orchidopexy, in general – the incision being placed over the inguinal canal.

Operation.—The undescended testicle is exposed in its inguinal bed – and the cord and testicle are sufficiently mobilized to enable the testis to reach the bottom of the scrotum or even beyond. An incision is then made in the bottom of the scrotum, through which a pair of long slender forceps are introduced, and through the upward passage of the instrument and the

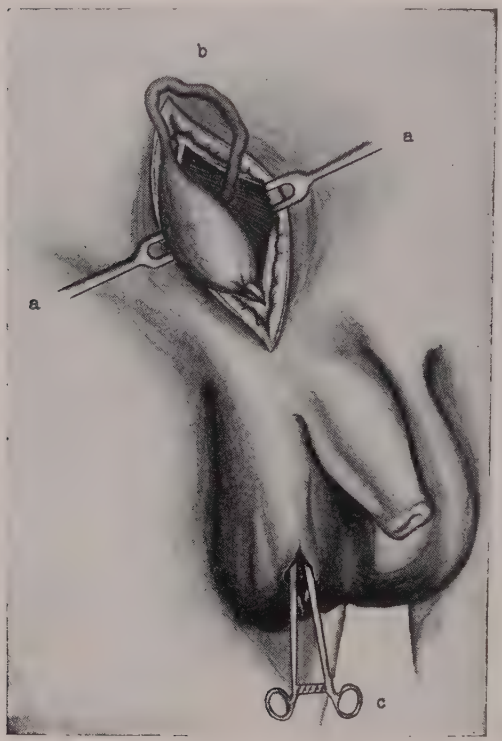


Fig. 5131.—Operation for Undescended Testicle – Hahn – I: – a, a, Retractors of the inguinal wound; – b, undescended testicle and cord delivered from the inguinal canal; – c, forceps have been introduced through a wound at the bottom of the scrotum, and have tunneled their way to the external abdominal ring – where they are seizing the testicle and are drawing it and its cord into the scrotum.



Fig. 5132.—The Same – II; – The testicle has been drawn down the new canal and through the scrotal opening – the extent of whose outlet has been shortened by a suture at either end – thus temporarily holding the testicle below the scrotum.

separation of its blades a sufficient passage is made for the testicle. The fibrous tissue at the lower end of the testis is then seized by the tunneling forceps (Fig. 5131) and draws the testicle down through the scrotum, and out beyond its floor, upon the surface of the skin. The ends of the incision through the floor of the scrotum are then sutured – sufficiently approximating the margins of the wound to prevent the drawing back of the testicle within the scrotum, and yet not tightly enough to dangerously constrict the parts (Fig. 5132). The inguinal wound is closed – and the exposed testicle receives a moist, sterile dressing, which is kept moist and will prevent its desiccation during the solidification of the parts. After adhesions have formed, in about a week, the ends of the lower scrotal incision are again opened and the scrotal skin in the neighborhood, entirely surrounding the exposed testicle, is mobil-



Fig. 5133.—The Same – III; – The neighboring skin is subsequently freed from the base of the testicle by blunt dissection and made to cover it by a plastic operation.

ized – after which it is drawn over the testicle and sutured (Fig. 5133). The testicle is thus held at the very bottom of the scrotum and even below.

BURGHARD'S METHOD OF SIMPLE ORCHIDOPEXY

Description.—The testicle and cord are mobilized and deposited within a pouch made for them in the scrotal sac – where the testicle is held, during healing, by the aid of Cheyne's wire testicle frame.

Preparation – Position – Landmarks – Anesthesia.—As in Bevan's operation (p. 814).

Incision.—An incision 2.5 cm. (1 inch) in length, parallel with the oblique course of the long axis of the inguinal canal, is placed over the external abdominal ring.

Operation.—The structures overlying the cord and the undescended testicle are incised in the same manner as in operating for the radical cure of oblique inguinal hernia. When this is done the testicle is sought and recognized as an important rallying point. The immediate coverings of the

cord are further incised down to the tunica vaginalis (processus vaginalis of the peritoneum), which is opened. This process usually opens into the general peritoneal cavity, and often contains a herniated knuckle of intestine _ which, if found, is returned to the abdominal cavity. Gentle traction is made upon the testicle and cord, which have been freed from their bed while, simultaneously, they are mobilized throughout the inguinal canal up to the internal abdominal ring. The adhesions of the processus vaginalis will usually interfere with the downward lengthening of the cord, and must be carefully snipped with scissors. The two chief barriers to the downward displacement and lengthening of the cord are the shortened processus vaginalis and the fascial tube surrounding the pampiniform plexus _ and must be divided sufficiently to let the testicle be brought down for the required distance _ even if all the vessels of the cord must be divided except the artery of the vas deferens and its veins _ and even although, in addition, the vas

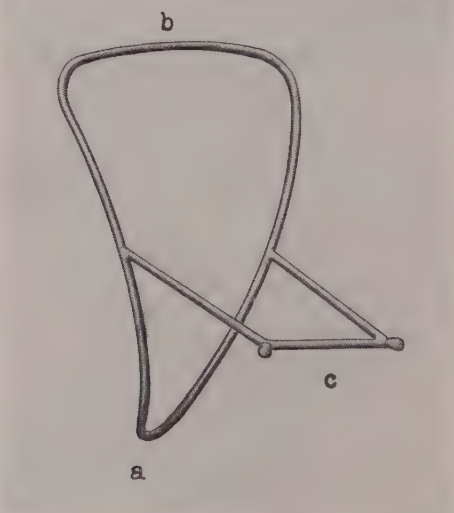


Fig. 5134.—Cheyne's Testicle Frame: _ a, Rests against the midperineum; _ b, is placed against the hypogastrium _ Strips of sterile zinc oxid plaster hold the framework in place; c, the cross-bar to which the suture which anchors the testicle in the scrotum is tied.

must be separated from the posterior aspect of the epididymis, so that the globus major becomes inverted (that is, the lowest part of the testicle instead of the highest).

A pocket for the testicle is now made in the scrotal sac _ by burrowing out a recess in the connective tissue by means of the finger. The special method of retaining the testicle within this pocket is the following technic: _ A piece of silk, of medium size, is passed through the tissues at the bottom of the testicle avoiding the epididymis, and endeavoring to pierce rather resistant structures _ after which both ends of the anchoring suture are threaded through the eye of a long, straight needle, which, guided by a finger in the scrotal pocket, is dame to pierce the bottom of the scrotum. The needle is then unthreaded, and the two limbs of the suture are separated and tied, somewhat tautly, around the cross-bar of the testicle frame (Fig. 5134). The testicle is thus drawn down and steadied against the resisting frame during the formation of the permanently anchoring adhesions of the parts in the period of healing.

The normal relationships must be maintained in placing the testicle within the scrotal pocket to avoid twisting the vas, with possible resulting gangrene of the testis. All bleeding vessels are carefully tied — and the wound is closed throughout, without drainage. If hernia be coincidentally present, radical operation for its cure is simultaneously carried out.

The patient remains in bed for two weeks — and every second day the bow-knot of the suture is untied, and the tension of the suture re-established, if it has slackened — until finally the suture will either have cut its own way out by about the tenth day — or may be drawn out.

ORCHIDOCELIOPLASTY

BURGHARD

Description.—This procedure consists in the permanent incarceration of the testis within the abdominal cavity. Ordinary orchidopexy, in which the testicle is anchored within the scrotal sac, however, it is stated by Burghard, should be invariably chosen in every case in which it is possible — further stating that he had never met a case in which it was impossible. He, nevertheless, denies the statement often made, that intra-abdominally retained testes become functionally useless — having encountered 5 cases of retained testes in adults well advanced in age with large numbers of active spermatozoa (v. p. 814).

He states, in summary, that orchidocelioplasty should only be performed in instances where the usual type of scrotal orchidopexy cannot be done — that, in these cases, the testicle should be returned well within the abdominal cavity (and not just within the internal ring — where it is exposed to injury — and may later serve as a dilator of the internal ring, and lead up to hernia) — that the internal abdominal ring should be closed — and that, prior to replacing the testicle within the abdomen, the vas deferens should be divided, so as to do away with the possibility of the spread of urethral infection to the testis (simple division of the vas not being followed by atrophy of the testicle, provided the nerves and vessels of the part be maintained — loss of procreative power alone being involved).

ORCHIDOTOMY FOR EXPLORATION, FOLLOWED BY ORCHIDORRHAPHY

Description.—The condition of the testis is sometimes not definitely ascertainable even after the scrotum is incised and the tunica vaginalis opened — and cases will arise in which, rather than needlessly sacrifice the gland upon any uncertainty, it is indicated to incise, even almost entirely bisect, the organ and thereby definitely determine its condition. If, then, no full warranty for total sacrifice be discovered, the halves of the organ, which have been hinged backward, are reapproximated by deep and superficial sutures, and the testis is restored to its bed, and the scrotal wound closed. Thus, for instance, tubercular foci discovered in the mediastinum of the testicle (in the body of Highmore) have been cureted, and the testicle closed by suture — whereas, on finding these foci in the parenchyma of the organ, the testicle has been removed. A section of tissue may also be examined for malignancy while the testis is open.

Orchidotomy.—The exposure of the organ is accomplished exactly as though the organ were going to be excised — by the method of first opening the tunica vaginalis — the details of which have been described and pictured (v. p. 827). After delivering the testicle through the scrotal wound and the split tunica vaginalis the gland is steadied between the Surgeon's left thumb,

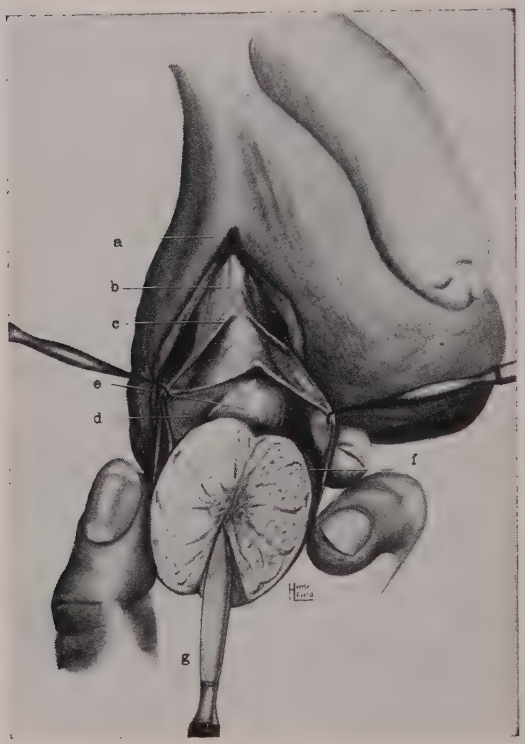


Fig. 5135.—ORCHIDOTOMY: – **a,** Anterolateral scrotal incision through which the testicle and cord are delivered; – **b,** cord; – **c,** tunica vaginalis communis; – **d,** lamina parietalis of tunica vaginalis propria testis; – **f,** lamina visceralis of tunica vaginalis propria testis; – **e,** epididymis. The testicle is seen bisected by the knife, **g,**

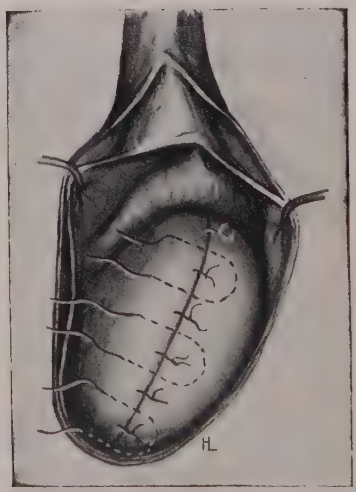


Fig. 5136.—ORCHIDORRHAPHY (which may be taken as the second step of the operation of Orchidotomy, Fig. 5135); – Deep mattress-sutures, placed ready to be tied, will approximate the deeper parts of the bisected organ – whose margins have been closed by superficial sutures. The deep sutures are usually tied first.

upon one side, and the first two fingers, upon the other – and a long, straight, narrow bistoury, with its back toward the base of the mediastinum testis, is thrust entirely through the testicle, entering just within its posterior border (so as to leave uncut enough tissue for hinging), and passing from pole to pole – and, with a steady sawing movement, the knife is made to cut its way from within outward, directly through the exact median aspect of the organ, thus wounding as few seminiferous tubules as possible – the fingers relaxing in advance of the knife cut, and compressing the divided halves in the tract of the section – (in the accompanying illustration [Fig. 5135] the incision is being less satisfactorily made from without inward, involving the division of more seminiferous tubules). When the testis is laid open, examination will determine whether a conservative operation may be carried out – or whether the organ must be excised – in the former event, the parts are sutured as described below – and, in the latter, the final steps are taken as described on pp. 827–832.

Orchidorrhaphy.—If the testicle have been very superficially cut, the lips of the incision can be readily brought together by superficial sutures alone, carried through the margins of the resistant tunica albuginea (Fig. 5136). In cases of deeper cleavage, amounting almost to total bisection, several mattress-sutures should be first employed as shown in the last illustration – and after these are tied the superficial sutures are placed. The incised tunica vaginalis is then sutured – and then the overlying scrotal tissues. Fine catgut sutures, preferably chromic, are used in all the buried suturing.

ORCHIDECTOMY

Description.—Orchidectomy, or castration, consists in the incision of the scrotum, followed by excision of the testicle and the structures of the lower part of the cord – followed by closure of the scrotal wound. The operation may be performed without opening the tunica vaginalis – or after incising it. Castration is almost always unilateral – rarely bilateral. The conditions for which the operation is most frequently performed are the following: – tumors of the testis, especially malignancy – local tuberculosis – in some exceptional cases of syphilitic testicle – in some cases of undescended testicle, where orchidopexy cannot be performed – in some cases of disorganizing disease and very extensive traumatisms. Castration has been performed in some unusual cases of inguinal hernia to aid in the mechanical security of the parts – but, in all probability, unjustifiably. Double castration for hypertrophy of the prostate gland, once so largely carried out, is now practically no longer performed. Before removing both testicles one should weigh matters well – as the dependence of the man, for good, healthy being, physical and psychical, apart from all sexual function, is now known to be so largely dependent upon the internal secretion of the testicles.

Preparation.—Scrotum and pubis shaved – and scrotum, penis, pubis, perineum, and inguinal regions cleansed and disinfected.

Position.—The patient lies supine, near the edge of the table, with the thighs slightly separated. The Surgeon usually stands to the patient's right in operating upon either testicle. The Assistant opposite.

Landmarks.—Testicle; cord; external abdominal ring.

Incision.—Vertical incision, from just above and over the external abdominal ring, down to the lower end of the scrotum upon the antero-external aspect of the cord – the scrotum usually being held in the palm of the left hand, with the index and thumb extending upward on either side and rendering the parts slightly tense. Where redundant, or diseased scrotal tissue exists

an elliptic incision may be made, including and removing the redundant or involved tissue. In simple cases, on the other hand, the testicle is sometimes digitally displaced upward into the inguinal region — so that a more limited incision of approach, made over the external abdominal ring, and thence downward, as short a distance as will suffice, in the course of the cord and testis, may be used.

Three types of operation will be considered:

(*a*) Excision of the Testicle Without Opening the Tunica Vaginalis: This is the form of operation usually carried out — and is indicated in all cases which are so clear cut in their nature as to require no exploratory examination of the condition of the testicle.

The incision of exposure is made directly down through the overlying parts (skin, dartos, intercolumnar fascia, cremasteric fascia, infundibuliform

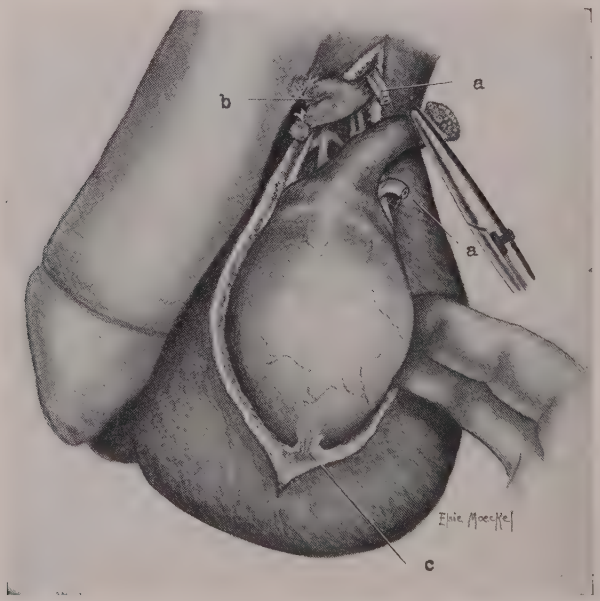


Fig. 5137.—Orchidectomy — I; — The testis, in its unopened tunica vaginalis, has been mobilized within the scrotal sac; — a, The vas deferens has been isolated and divided; — b, the vascular structures of the cord have been divided into two bundles, ligated, and divided; — c, the ligamentum scrotale testis (of Waldeyer), the remains of the gubernaculum testis, is exposed and about to be divided.

fascia) to the cord and tunica vaginalis — the cavity of which should not be incised — the technic being thereby easier — and infection of the general wound less likely. By blunt dissection, aided by snips of scissors, if necessary, the testicle, with its unopened tunica vaginalis, is shelled out of its bed — along with the beginning of the spermatic cord and its structures — or, if not literally shelled out, and delivered outside of the scrotal wound, is, at least, everywhere freed from its overlying and surrounding structures (Fig. 5137). At the lower end of the wound the ligamentum scrotale testis (the scrotal ligament of Waldeyer) usually offers sufficient resistance to require to be cut. At the upper end of the scrotal wound the structures of the cord are to be dealt with — which is best accomplished after the delivery of the testicle outside of the scrotum. The structures of the cord are, at first, delivered *en masse* — and are generally freed, in this form, up to about 2.5 cm. (1 inch) below or

even quite to the external abdominal ring. No attempt is ordinarily made to literally isolate the component structures of the cord (see Anatomy of the Cord p. 833) – and occasionally, though not wisely or even safely (as to possible postoperative hemorrhage), all the structures of the cord, including the vas deferens, are tied in one bundle. If the structures of the cord lend themselves to being teased apart, in the special case, this may be done to the extent the Surgeon may deem wise if he desire to make more or less individual ligation of the component structures. At any rate, the structures of the cord, as a whole, should be divided into at least two bundles – one consisting of the vas deferens and its vessels – and the other, of the spermatic artery and its veins. Other Surgeons prefer to isolate the vas deferens and tie it separately – and then take up all the vessels of the cord, arteries, and veins in a second ligature. Chromic catgut is employed in these ligatures – and

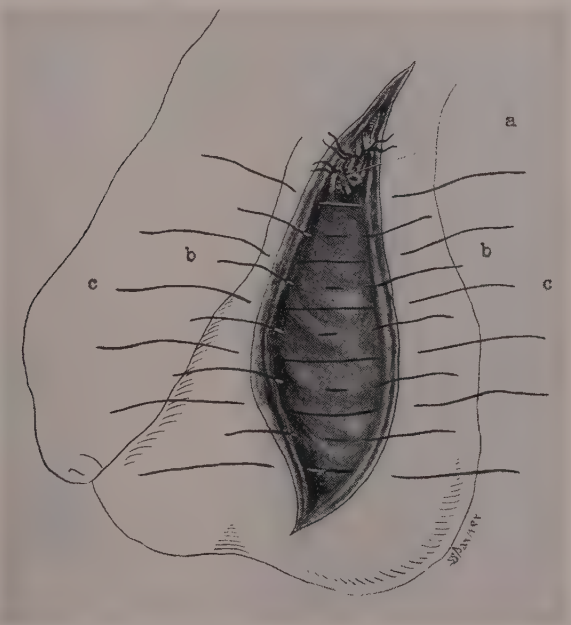


Fig. 5138.—The Same – II; – Three groups of ligated vessels, including the vas deferens, are seen forming the pedicle, a; – b, b, buried sutures, closing the connective-tissue bed of the empty sac; – c, c, sutures of margins of scrotal wound.

the structures are tied either a short distance above the testicle, or a short distance below the external abdominal ring. All bleeding vessels of the scrotal wound are clamped and tied with fine chromic catgut – and are usually the superior external pudic, inferior external pudic, superficial perineal, and the artery of the septum scroti. The cord, finally, is divided below the ligature and the testicle removed. The scrotal wound is then put upon a slight stretch by wound hooks, and sutured throughout, if the hemostasis have been satisfactory, so approximating the edges as to prevent in-turning – using interrupted sutures of chromic catgut, silkworm filament, or silk. Less likelihood of hematoma is present if the testicular bed be brought together by buried sutures (Fig. 5138). If indicated, temporary drainage may be used in the lower part of the scrotal wound. The scrotum is well supported by dressing.

When the shorter incision is made over the external abdominal ring it is

extended downward to the upper level of the tunica vaginalis _ after which the testis, covered by its tunica vaginalis, is drawn upward out of the opening in the scrotum.

Sometimes the cord is ligated *en masse*, and when this is done, it is well to first crush its structures by means of such an instrument as Doyen's clamp (Fig. 5139), after which the cord can be more securely tied in the middle of the crushed tract.

In some cases of disease even other than cancerous _ and in cases where sinuses complicate the case _ it is often indicated to open up the inguinal canal _ and to include sinus tracts in outlining incisions.

Sometimes the cord is first clamped, then cut, and finally ligated.

If the arteries of the cord can be recognized and separately tied, it is somewhat more surgical than to include arteries and veins in the same ligature.

(*b*) Excision of the Testicle After Making an Exploratory Opening of the Tunica Vaginalis: In cases where the condition is not definitely known, and

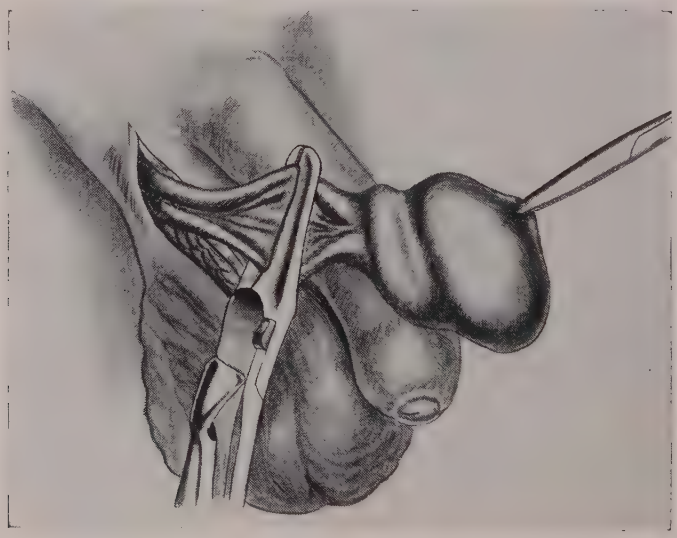


Fig. 5139.—Orchidectomy By Clamp and Ligature; _ Tractor, supporting the testicle, which has been delivered from its scrotal sac; _ angiotribe crushing the structures of the cord preparatorily to ligating the crushed tract in its center.

where it is wiser to examine the testicle by touch and sight before concluding to sacrifice it, the tunica vaginalis should be incised before tying the cord, or otherwise irreparably damaging the structures. The operation is conducted, in the main, in the same manner as the technic just described. The period in the procedure at which the incision of the tunica vaginalis is incised will differ according to the nature of the case, or its supposed nature, and the judgment of the Surgeon. As a rule the testicle and its unopened tunica vaginalis are first freed and delivered entirely outside of the scrotal wound, precisely as in the last method, before incising the tunica vaginalis. This technic has the advantage in those cases where the incision of the tunica then reveals the necessity for the removal of the testis, that the operation is then already nearly completed _ and the disadvantage (not of serious consequence, however), in those cases in which the incision of the tunic reveals the non-necessity for excising the testis, that considerable unnecessary traumatism has been

committed upon the scrotal tissues, necessitating, in turn, the replacement of the shelled-out testicle into the raw scrotal sac. If this plane of action, however, have been decided upon, the tunica vaginalis is simply incised when the testicle and its unopened tunica vaginalis have been delivered from the wound _ and the further course then decided upon.

Where, on the opposite hand, it is decided to examine the testicle *in situ*, on reaching the tunica vaginalis, in the orginal incision, that structure is incised at the bottom of the scrotal incision, and as it lies within the scrotal sac, unseparated from its surrounding tissues. This procedure is represented in Fig. 5140 _ where also is shown diagrammatically the manner of dealing with the structures of the spermatic cord, supposed to be seen without their connective-tissue bindings. Under these circumstances if the examination

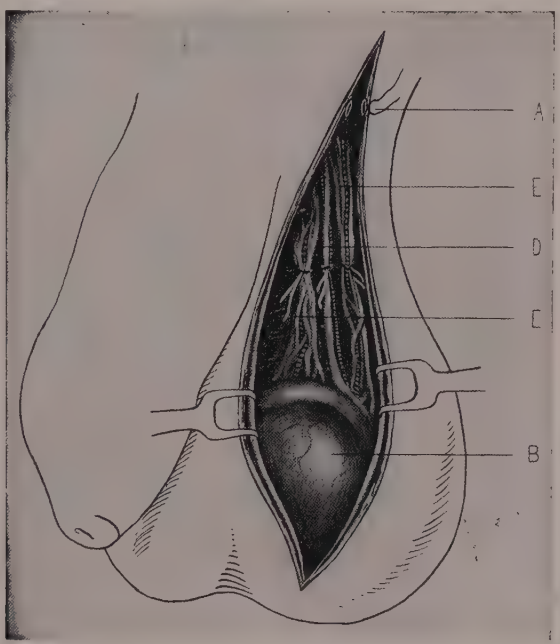


Fig. 5140.—ORCHIDECTOMY _ incising the tunica vaginalis and exposing the testis *in situ:* _ A, Superficial vessel in lip of incised scrotum; _ B, testis; _ C, spermatic artery and pampiniform plexus of veins, ligated; _ D, vas deferens and artery, ligated; _ C, cremasteric artery and posterior spermatic veins, ligated.

determines the desirability of removing the testicle, the structures of the cord are ligated and divided, and the testis removed, with or without parietal portion of its tunica vaginalis. If, in these cases, the parietal tunica vaginalis is to be excised, it must be dissected from the overlying scrotal coverings before it can be removed. If excision of the testicle is not to be carried out, the incised tunica vaginalis is sutured _ and the scrotal wound over it is closed.

(*c*) Radical Excison of the Malignant Testicle Together with the Direct Structures of its Tract: This procedure is a distinctly more formidable undertaking _ involving, as it does, the removal of lymphatic glands around the aorta and vena cava which receive afferent vessels from the testicles, and whose removal must be accomplished if the operation is to be radical. The outline of the technic carried out by Taylor will be here given _ which includes the

removal of the testicle, spermatic artery (up to the aorta), spermatic vein (nearly to the vena cava) on the right, and to the renal vein on the left, the lymphatic vessels from the testicle, and the glands into which they empty, together with the fatty areolar tissue of the tract in which these structures lie – the structures being removed *en masse* as much as possible.

The skin incision begins upon the scrotum, over the tumor, and extends over the cord, to the external abdominal ring – thence outward to a position 2.5 cm. (1 inch) internal to the anterior superior iliac spine – and curves thence upward in the direction of the costal margin opposite the tip of the tenth rib.

The spermatic cord and the testicle are exposed – and if there be any further doubt about the nature of the testicular involvement, the testicle may be bisected and examined, in the manner described under Orchidotomy, p. 825.

If it be indicated to proceed with the operation, the upper part of the above incision is carried out, and deepened through the abdominal muscles – until the peritoneum is reached. The cord is traced to the internal abdominal ring, where the vas deferens dips into the pelvis, and whence the spermatic artery passes upward to the aorta, and the spermatic vein upward to the vena cava (or to the left renal vein). By drawing upon the spermatic cord the spermatic vessels are made more evident and are more easily followed – the unopened peritoneum being rolled and retracted upward and inward. The vas deferens is followed as far into the pelvis as it can be traced, and is there doubly ligated and divided (preferably by cautery). The spermatic artery and veins are then ligated as near their main vessels as possible. The lymphatic structures are wiped away with a dry gauze-covered finger over an area extending from the renal vessels, above, to the bifurcation of the common iliac below, and from the median line, internally, to the outer boundary of the psoas muscle, externally. Any bleeding vessels encountered are tied with fine catgut. Injury to the ureter is avoided. Finally, the temporarily retracted peritoneum is replaced – and the extensive wound closed – partly by buried chromic catgut suture – and partly by surface suturing with silkworm filament. Temporary retroperitoneal drainage may be used if indicated – by counter-opening between the iliac crest and the last rib.

CHAPTER LXXXI

OPERATIONS UPON THE STRUCTURES OF THE SPERMATIC CORDS _ INCLUDING THE EPIDIDYMES, THE VASA DEFERENTIA, AND THE VESSELS

Surgical anatomy of the spermatic cords, including the epididymes, vasa deferentia, and the vessels, p. 833.

Operation for the radical cure of varicocele (Bennett's modification of Howse's technic), p. 834; _ Operation for the cure of hydrocele by subcutaneous ligature, p. 836.

Vasotomy _ Vasostomy, p. 837; _ Vasorrhaphy, p. 838.

Partial vasectomy, p. 839; _ Excision of the epididymis and major portion of the vas deferens, or epididymovasectomy (Cabot's technic), p. 840.

Total vasectomy, together with vesiculectomy and orchidectomy, p. 842.

Puncture of the epididymis and epididymotomy, p. 844.

Epididymectomy, p. 845.

Anastomoses between various portions of the intrascrotal seminal tract, following operative interruption, or pathologic obstruction of the tract, chiefly epididymal, p. 847.

SURGICAL ANATOMY OF THE STRUCTURES OF THE SPERMATIC CORDS—INCLUDING THE EPIDIDYMES, VASA DEFERENTIA, AND THE VESSELS

Structures of Cord.—Consist of the vas deferens (which begins in the globus minor of the epididymis), arteries, veins, lymphatics, nerves, processus vaginalis, and internal cremaster of Henle _ all connected by areolar tissue and surrounded by the fasciæ which descend, together with the testis, from the internal abdominal rings, through the inguinal canals, into the scrotum to the summit of the testis.

Arteries of the Cord.—Spermatic, of abdominal aorta _ lying anterior to vas deferens and surrounded by pampiniform plexus of veins; artery of vas deferens, of superior, or inferior vesical _ accompanying vas deferens upon its lateral aspect; cremasteric artery, of deep epigastric _ lying superficially and upon the external aspect.

Veins.—Most of the spermatic veins pass through the inguinal canal and empty into the inferior vena cava on the right _ and into the renal vein on the left. They may be divided into three sets: _ (**1**) Anterior Set _ much larger, form pampiniform plexus, accompany the spermatic artery and ascend the cord anterior to the vas; _ (**2**) Posterior Set _ much smaller, surround the vas deferens and accompany the artery of the vas; _ (3) Some independent veins.

Lymphatics.—Empty into the Lumbar Glands.

Nerves.—From the spermatic and pelvic plexuses.

Vas Deferens.—Lying posteriorly and recognized by its cord-like feeling.

Processus Vaginalis.—Remnant of obliterated tube of communication between tunica vaginalis and peritoneum.

Internal Cremaster of Henle.—Scattered bundles of muscle-fibers.

Fatty Areolar Tissue.—Connecting constituent structures of cord.

Epididymes.—Formed by vasa efferentia _ which pierce the tunica albuginea and, becoming convoluted into the coni vasculosi, form the globus major, at the upper inner aspect of the testicle. The vasa efferentia thus unite to form the body of the epididymis along the inner aspect of the testicle _ ending below in the globus minor, at the lower inner aspect of the testicle _ which terminates in the vas deferens.

Vasa Deferentia.—Continuation of the epididymes _ extending from the globus minor to the prostatic urethra. Ascends on the inner side of the epididymis and back of the testis _ passing vertically up the cord, posterior to the spermatic vessels _ enters the external abdominal ring _ runs through the inguinal canal _ emerging from the internal abdominal ring, it passes around the outer side of the origin of the deep epigastric artery and runs downward and inward, crossing the external iliac vessels into the pelvis, to the side of the bladder, running under the peritoneum _ thence curves backward and downward to the posterolateral surface of the bladder _ crossing over the cord of the obliterated hypogastric artery, and lying internal to the ureter, passing between the ureter and bladder _ thence it ceases to be covered by peritoneum, running forward to the base of the prostate, lying between the bladder and rectum and attached to the former (bladder) _ being placed internal to the vesiculæ seminales. Near the base of the prostate each vas enlarges somewhat (ampulla) and joins the duct of the corresponding seminal vesicle, to form the ejaculatory duct of that side _ the ejaculatory duct opening into the sinus pocularis of the prostatic portion of the urethra. After the vas ceases to be subperitoneal, it is invested by rectovesical fascia and a prolongation of the subperitoneal tissue. The efferent ducts consist of cellular, muscular, and mucous coats. Its artery is the artery of the vas deferens, a branch of the superior vesical, of the internal iliac. Its lymphatics end in the iliac glands. The angle of approximation of the ejaculatory ducts lies immediately above the prostate. For the anatomy of the ejaculatory ducts see the vesiculæ seminales.

OPERATION FOR THE RADICAL CURE OF VARICOCELE

BENNETT'S MODIFICATION OF HOWSE'S OPERATION

Description.—Consists in an incision of the scrotum and cord, with a partial excision of the pampiniform plexus of veins (which is the set chiefly involved in varicocele) _ followed by suturing of the proximal and distal ends of the severed plexus together.

Preparation.—Pubis and scrotum shaved.

Position.—Patient supine, at edge of table. Surgeon on side of operation. Assistant opposite.

Landmarks.—Site of varicose tumor. Position of testicle and cord. External abdominal ring.

Incision.—Longitudinal incision, about 4 to 5 cm. ($1\frac{1}{2}$–2 inches) in length, made over the structures of the cord, with its center over the site of the greatest varicosity.

Operation.—As soon as the incision is made through skin and fascia, the bleeding vessels are clamped and tied _ and two silk retraction loops are put into the lips of the wounds and these lips well retracted _ thus exposing the structures of the cord. The vas deferens is the first structure of the cord to be identified _ and this is done for the purpose of henceforth avoiding injuring it. This structure and its artery, and the posterior set of veins accompanying it, are kept as much out of the field as possible. The pampiniform plexus of veins, together with the surrounding fascia especially preserved and unopened, are isolated from the more important structures and are freed for about 4 to 5 cm. ($1\frac{1}{2}$–2 inches), according to the size of the varicocele, by blunt dissection.

Strong chromic gut ligature is carried, upon an aneurysm needle, around the lower portion of the freed part of this plexus of veins and tied tightly, both ends being left long. The same is then done at the upper portion of the freed part _ the ligatures being about 4 cm. ($1\frac{1}{2}$ inches) apart. About 2.5

cm. (1 inch) in extent of this venous plexus is now removed with scissors—which cut about 6 mm. ($\frac{1}{4}$ inch) from each ligature. One of the free ends of each ligature is now threaded and carried through its own end, so as to come out opposite the knot. The two ends which were threaded are then tied together. The other two ends are similarly treated and tied. The free ends of the venous plexuses left by the excision are thus approximated, together with their sheaths of surrounding fascia – thus shortening the cord and partially taking the weight of the lower part of the cord from the scrotum. The wound is then sutured throughout (Fig. 5141).

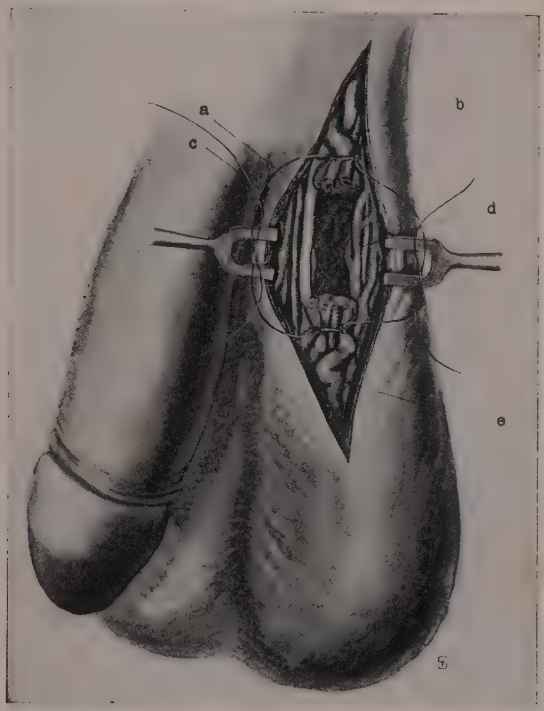


Fig. 5141.—Bennett's Modification of Howse's Operation for Varicocele; – Between the retracted lips of the scrotal incision are seen two stumps left by excision of the bulk of the scrotal veins (pampiniform plexus). After each ligature is placed the needle is carried directly through the stump, thus leaving two ligature ends on either side – the tying of the two rights together, and the two lefts together, approximate the stumps and hold their ends in contact, as well as shorten the mass: a, Vas deferens; – b, spermatic artery; – c, artery of vas deferens; – d, cremaster artery; – e, pampiniform plexus of veins. For the sake of clearness the vessels are not here shown surrounded by their fascial sheath.

Comment.—As much in length of the plexus may be removed as considered necessary in the special case.

Isolation of the veins to be ligated is aided by passing a director above, and one below, between the veins to come away and the structures to remain – and then separate the parts upward and downward in this line.

Especially avoid opening the fascial sheath surrounding the veins of the pampiniform plexus to come away – as they are much more readily manipulated when intact.

Avoid cutting the cremaster muscle.

Avoid removing an excess of vascular structures – for fear of damaging the blood-supply of the part too greatly.

The addition of a second chromic catgut suture through the ends of the ligated stumps in the opposite plane to that shown in the picture, that is, anteroposteriorly, will accomplish a more accurate apposition of these stumps.

It is to be remembered that the possibility of unconsciously including the vas deferens in the ligature is very real _ with the consequent responsibilities. The Author once witnessed an operation for varicolcele, performed by one of the very foremost Surgeons of the country, where, after announcing to those about him that he had inadvertently tied in the vas upon the side upon which he was operating, within a few minutes after also tied in the vas of the opposite side. He recognized both errors before closing the wounds, fortunately, and cut the tightly tied knots _ but whether the vasa deferentia were not permanently damaged by their temporary tight tying is not known.

As tying the structures of the spermatic cord is rather painful, anesthesia is preferable to analgesia.

OPERATION FOR THE CURE OF VARICOCELE BY SUBCUTANEOUS LIGATION

In this technic catgut ligatures are subscutaneously conducted by needle around the involved veins, in several sites, and tied _ the skin being nowhere

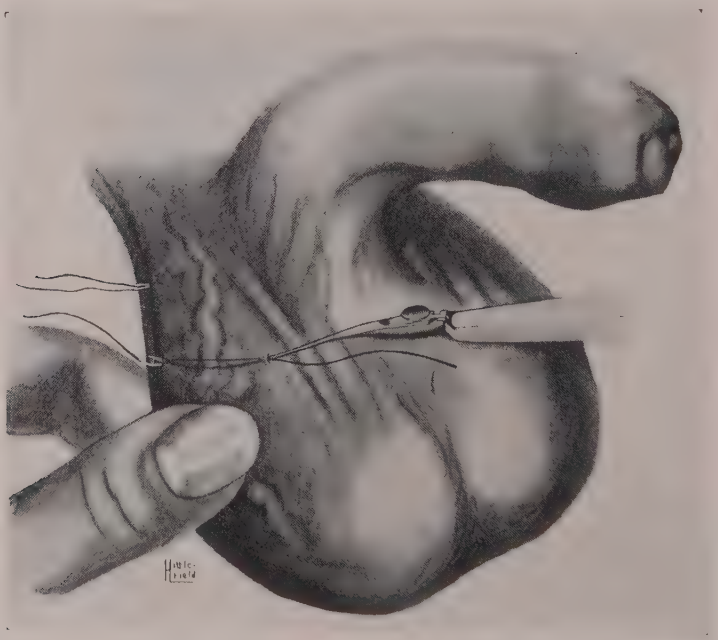


Fig. 5142.—Operation for Varicocele by Subcutaneous Ligation of Prominent Veins in One or More Places; _ The veins have been drawn away from the isolated cord (seen in outline, mediad). A Reverdin needle is in the act of carrying, subcutaneously, a ligature beneath the veins, and then between the veins and the skin, preparatory to tying. The outer end of the thread will be fed to the needle and then be drawn mediad.

opened except for the needle punctures. Novocain analgesia is generally employed.

The method is distinctly inferior to the open procedure last described _ as, of necessity, much inaccuracy must result from working in the dark _ and since the vas has been so often inadvertently tied even in the open method,

it must be admitted that the danger is increased in the hidden method. The danger to the arteries is even greater. The operation is not to be recommended.

If the operation, however, be carried out, the technic is as follows:

A Reverdin needle and chromic catgut (sometimes silk) are employed. The Operator undertakes to recognize the vas deferens and its vessels by the sense of touch, and to displace them to the posterior aspect of the scrotum, and to hold them out of the way during the operation. He then endeavors to include the prominent clusters of veins of the pampiniform plexus within the subcutaneous ligatures. Isolating such a cluster, he first carries the threaded Reverdin needle through the scrotal skin, as near the veins as possible – closely beneath the veins – and out through the skin on the opposite side of the veins. The loop of the ligature is then seized, and one end drawn through on one side, leaving the other end protruding from the needle hole of entry. The needle is then drawn backward, empty, until its point has nearly but not quite emerged from the original hole of entry – and is again thrust forward, but this time above the veins, between them and the skin – to emerge through the original needle hole of emergence. There the free end of the ligature is fed to the needle – and it is finally withdrawn through the original hole of entry (Fig. 5142). The ligature is then tied tightly – aiding by digital manipulation, the slipping of each knot of the ligature down upon the vessels sufficiently tightly to constrict them. If necessary, a little controlled jerk of the scrotal skin will cause the knot to slip through the resistant dartos and become buried. Several such ligatures are usually placed.

It would seem doubtful whether the majority of such ligatures are ever drawn tightly enough to obliterate the vessels.

VASOTOMY—VASOSTOMY

Vasotomy, the incision of the vas deferens – and vasostomy, the formation of a temporary opening of the vas upon the skin – have sometimes been performed for the purpose of securing a route for the injection of medicated solution into the vas deferens, ampulla, and seminal vesicle – in the direct local treatment of seminal vesiculitis, acute and chronic.

The vas deferens is carefully isolated, within the unopened scrotum, by manipulation between the fingers – and, while it is brought near to the surface of the skin, at some convenient point between the external abdominal ring and the postero-external aspect of the upper part of the scrotum, and held there, two straight needles (about 5 mm. or 3/16 inch apart) are passed through the skin, beneath the vas, and out through the skin again, being most careful not to injure either the vas or its vessels. The scrotal skin is then incised directly over the vas, the edges of the wound are retracted, and the vas itself is brought into the field by combined blunt and sharp dissection, but scrupulously avoiding traumatism to vas or vessels during the dissection. While the vas is steadied behind by the two needles upon which it rests, a limited transverse incision is first made with very fine scissors (or eye scissors) through about one-third of its circumference – and into this transverse cut one blade of the fine scissors is inserted and the transverse cut enlarged by the addition to it of a very limited axial incision of the vas. A small curved needle (intestinal), armed with silk, is then carried into the lumen of the vas, first in an upward direction, and its point made to traverse, from mucosa outward, the thickness of the vas and the lips of the upper aspect of the scrotal skin incision, and is tied – and, similarly, another needle and suture are carried in a downward direction, through the mucosa, wall of the vas, and overlying structures, and tied to the lower aspect of the skin incision. If additional sutures are required to complete the vasostomy they are placed.

This opening gives access to the lumen of the vas, and thence, to the ampulla and seminal vesicles – the patulousness of which may be maintained as long as this form of local treatment is desired. The medicated fluid is conveniently injected into the canal of the vas by means of a hypodermic syringe outfit, the end of whose needle has been blunted or broken and then smoothed.

When the opening in the vas is no longer desired, an opportunity is first given it to close by granulation, with maintenance of its lumen. If this do not succeed, the site of the vasostomy may be mobilized, from its adhesion, and another opportunity given it to heal spontaneously. As a final resort the portion of the tube involved in the original operation may, after mobilization of the part, be closed by vasorrhaphy in the same manner as after a complete transverse division of the tube (v. i.).

VASORRHAPHY

MAYO-BURGHARD TECHNIC

Description.—The suturing of a partially or totally divided vas deferens – the operation being preferably performed at the time of the division, which

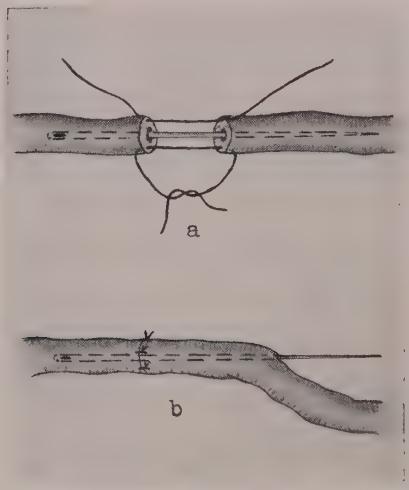


Fig. 5143.—VASORRHAPHY – Mayo-Burghard Technic: – a, The needle in position, but with the ends of the divided ureter still separated, and with two of the sutures inserted; – b, the suturing completed and the needle about to be withdrawn.

is usually by accident, in some operative procedure (especially in operating for hernia and for varicocele) – though the necessity for it may not be discovered until later, when the ends of the cicatrized vas are preliminarily freshened.

Operation.—The divided ends of the vas are exposed – which usually amounts to their being found, after being accidentlally cut in some operation – and cleansed by sponging. They are squarely cut if necessary. The eyed end of an ordinary straight needle of appropriate size to fit snugly is carried into the lumen of one of the ends for about 2.5 cm. (1 inch), it matters not which. The pointed end of the needle is then introduced into the opposite end of the divided vas – which is threaded upon it, as it were, for about 2.5 cm. (1 inch) – by which time it will have pierced, or is made to pierce, the entire wall of the second end of the vas (Fig. 5143, a). The two ends of the

divided vas are then pushed closely together. While the ends of the tube are thus supported upon the needle as a distending form – their union is accomplished by suturing them together by four non-penetrating sutures of the finest catgut, carried upon a fine curved eye needle. The sutured part finally presents the appearance shown in Fig. 5143, **b**. The sutured vas is further reinforced, at the site of the suturing, by being buried in the tissues of the cord, while the needle is still *in situ*, which are sutured over them, splint fashion, by one or more buried catgut sutures. Finally, the needle is withdrawn – the hole in the wall of the vas closing after it. The scrotal wound is closed without drainage.

The Mayos employed catgut, knotted at both ends, as a support, instead of the needle, and left it in the vas for natural absorption. The needle, however, gives better support for manipulation.

PARTIAL VASECTOMY

Partial vasectomy consists of the excision of a limited portion of the vas deferens – the area of excision being bounded by ligatures on either side.

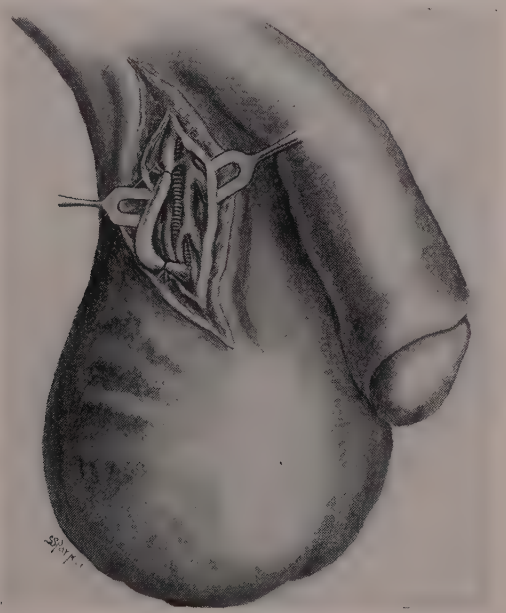


Fig. 5144.—Partial Vasectomy – illustrating the removal of a segment of the cord between two ligatures.

This technic was, formerly, quite often performed – for the purpose of producing atrophy of the hypertrophied prostate gland (instead of resorting to castration).

The operation is now no longer employed for this purpose – enucleation of the prostate gland being resorted to as being altogether more satisfactory.

When the operation was carried out, an incision was made in the course of the spermatic cord, beginning just below the external abdominal ring, and extending downward for about 4 cm. ($1\frac{1}{2}$ inches). The skin and fascia were incised – and the superficial vessels clamped. The spermatic cord was exposed just below the external abdominal ring – the vas located – and isolated from its accompanying structures. Two catgut ligatures were placed upon it,

about 2 cm. ($\frac{3}{4}$ inch) apart, and tied – after which about 1.3 cm. ($\frac{1}{2}$ inch) of the cord was excised (Fig. 5144). The wound was closed without drainage.

A field for the possible application of vasotomy or partial vasectomy might, for instance, arise where it is found impossible to bring an undescended testicle down into the scrotum – necessitating the permanent placing of the gland within the abdominal cavity. In such a case rather than run the risks of intra-abdominal involvements of the testicle subsequently, from infection arising within the urethra and transmitted thence along the vas deferens, it is generally advised to sever the vas of the testicle about to be consigned to the abdominal cavity.

EXCISION OF THE EPIDIDYMIS AND MAJOR PORTION OF THE VAS DEFERENS—EPIDIDYMOVASECTOMY

CABOT

In some cases of more or less extensive involvement it is indicated to remove the entire epididymis, together with the upward extension of the

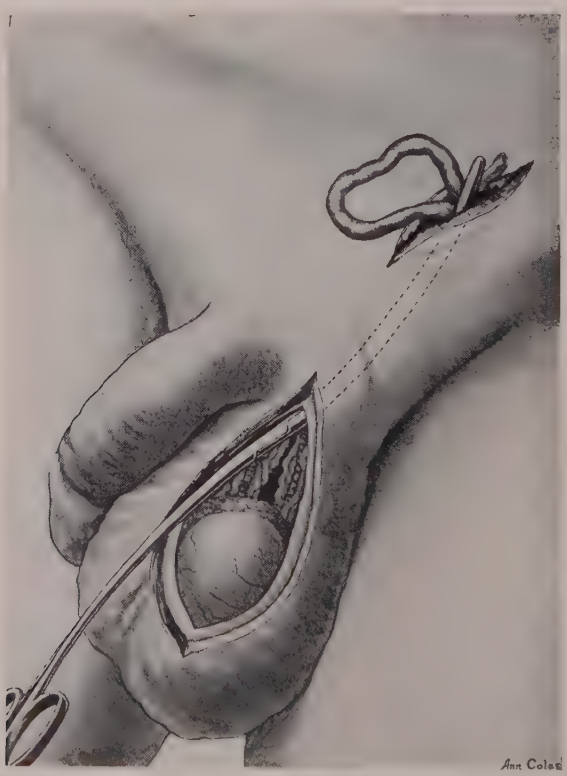


Fig. 5145.—Epididymovasectomy – Cabot – I; – The epididymis has been excised – the vas, dissected up to the external abdominal ring, has been seized by a clamp and carried through the inguinal canal – at the outer end of which, directly over the internal abdominal ring, an incision has been made down upon the end of the clamp, which is then protruded through the skin wound, bringing the divided end of the cord with it.

vas deferens. The following method of excising these structures up to the internal abdominal ring, as worked out by Cabot, is here given. The pro-

cedure is carried out either under novocain analgesia or under nitrous oxid and oxygen anesthesia _ after preparing the skin of the scrotum and groin.

The operation begins by an incision of about 5 cm. (2 inches), placed over the epididymis, circumscribing any sinuses which may be present, if any. This incision is deepened through skin, fascia, and the scrotal coverings of the tunica vaginalis _ which is incised at the bottom of the wound and its cavity exposed _ breaking down whatever adhesions of its surfaces may exist. Having delivered the testis and the epididymis from the cavity of the tunica vaginalis, the involved epididymis is dissected from the testicle by sharp-pointed, curved



Fig. 5146.—The Same _ II; _ While the cord is held and tensed in the right hand, the Surgeon's left forefinger, introduced through the internal abdominal ring, frees the cord as far down into the pelvis as possible preparatorily to its being clamped and divided.

scissors with care to preserve the vascular structures upon its posterior aspect _ carrying on the separation from before backward, and from above downward. The lower end of the vas immediately next the tail of the epididymis is then freed of its surrounding structures and clamped _ after which the portion of the cord between the clamp and the epididymis is divided _ and the epididymis removed. Grasping the clamp which holds the divided end of the vas, the cord is freed by blunt dissection, digital and instrumental, up to the external ebdominal ring. Having tunneled with the finger a passage from the upper and of the scrotum to the external abdominal ring, and into its entrance, and

guided by the finger, the slightly curved clamp which has held the lower end of the divided cord is carefully protruded through the inguinal canal, still grasping the end of the cord, until the tip of the clamp is felt to be opposite the internal abdominal ring. Then by depressing the handle of the clamp and elevating its tip against the skin of the groin a limited incision, by knife, is made directly down upon the end of the clamp, holding the divided vas _ which is then pushed through the opening together with the clamped cord (Fig. 5145). The cord is now grasped by the fingers of the right hand and the clamp withdrawn. The detached portion of the cord is drawn out of the inguinal canal _ so that when the structure is put upon gentle stretch its direction will be vertically downward into the pelvic cavity. The Surgeon, guided by the slightly tensed cord held almost vertical, follows the cord downward through the internal abdominal ring, separating it from its attachments as far as it is possible to introduce the finger and accomplish this (Fig. 5146). Finally, an angular clamp is made to follow the finger and seize the cord as low as possible _ after which it is divided, its divided end cauterized with carbolic acid, and allowed to recede into the pelvis. (It would seem as well to also ligate the divided ends, scrotal and abdominal.

The small inguinal wound is brought together by a single buried catgut suture, followed by silkworm sutures of the skin. The testis may be bisected, and any foci of disease which may be found cureted _ after which the testicle is sutured. After painting the wound with tincture of iodin, it is closed by subcutaneous silkworm stitch _ up to the exit of a small, temporary drain.

The routine use of tuberculin follows the operation in tubercular cases.

It might be well to close the internal abdominal ring with a buried chromic catgut stitch or two before closing the inguinal wound _ against possible hernia.

TOTAL VASECTOMY, TOGETHER WITH VESICULECTOMY AND ORCHIDECTOMY

Description.—The excision of the entire vas deferens, including its ampulla, together with the removal of the seminal vesicle and the testis, is sometimes indicated in such conditions as tuberculosis or malignancy of the seminal tract _ testis, vas, and seminal vesicle _ and constitutes a major surgical procedure. Instead of removing the whole vas and the testicle and seminal vesicle at its two ends, it may only be necessary to remove the testicle and vas _ or the seminal vesicle and vas.

The general features of the extensive excision of these three structures will partake largely of the technic of orchidectomy (v. p. 827) as far as the removal of the testicle is concerned _ and of vesiculectomy as far as the removal of the seminal vesicle goes _ to which will have to be added the technic of removing the vas which intervenes between these two end structures. The procedure, therefore, is threefold _ and takes place in three different fields.

Preparation _ Position _ Landmarks _ Anesthesia.—Are those which are separately described under Orchidectomy (p. 827) and Vesiculectomy (v. Index, Vol. VI) _ together with the features which will be described in the exposure of the vas between these structures.

Operation.—In so large a surgical undertaking as the total removal of the vas, together with the testicle and seminal vesicle, several more or less complicated methods of procedure have, naturally, been worked out. The following technic, or combination of technics, is probably the best:

(*a*) **Removal of the Seminal Vesicle and the Ampulla of the Vas With the Freeing of the Pelvic Portion of the Vas _ Through the Perineum.**—

The seminal vesicle and the ampulla are removed, and the pelvic part of the vas mobilized through one of the operations of vesiculectomy, to be described (v. Index, Vol. VI) – according to the election of the Surgeon. Having excised these structures and closed the wound with a temporary drain inserted, the patient is placed in the dorsal posture.

(*b*) **Removal of the Pelvic and Abdominal Portions of the Vas Through an Inguino-abdominal Incision.**—This incision extends from over the cord, in the upper part of the scrotum, upward and outward, parallel with Poupart's ligament, and about 2.5 cm. (1 inch) above it, to just beyond the internal abdominal ring. The skin and fascia are divided, and the external oblique aponeurosis and muscle are split in the same line, upon a grooved director passed through the external ring. These divided structures are retracted to. each side and the inguinal canal throroughly exposed, with its contained cordc The vas deferens is carefully freed from the other elements of the spermatic cord by careful dissection, chiefly blunt – up to and into the internal abdominal ring. The Surgeon now carries his left forefinger through the internal abdominal ring and separates the peritoneum from the abdominal wall – causing his finger to serve as a blunt dissector of the unopened peritoneum, protector of the deep epigastric artery, and as a guide for the knife in the incision which is now made from the internal inguinal ring across the internal oblique and transversalis toward the outer border of the rectus muscle – and, if necessary, further upward to the level of the umbilicus, if need be along the outer border of the rectal sheath. The boundaries of this incision are held apart by deep abdominal retractors, so that the vas may be further freed with as little damage as possible to surrounding structures and danger of breaking the vas itself through traction. The adhesions and connections of the vas must be carefully freed in working deep in the pelvis – until the stump of the vas, where it was ligated at the ampulla, through the perineal wound, is reached (v. the Anatomy of the Vas, p. 833). Only gentle traction is admissible, for the vas may be quite friable and break. The deep epigastric vessels are held to the inner side by one retractor – and the unopened peritoneum and contained viscera are displaced upward by the other. When the pelvic portion, still continuous with the inguinal part of the vas, has been delivered out of the abdomen, the rather extensive abdominal wound is repaired by tier suturing with chromic catgut – including the reconstruction of the internal abdominal ring, the inguinal canal, and the external abdominal ring. With the pelvic and inguinal portions of the vas freed from their beds and delivered out of the wound the last step of the operation is carried out.

(*c*) **Removal of the Testis and of the Scrotal Portion of the Vas Deferens by Scrotal Incision.**—This part of the technic, simple as compared with the preceding steps, is accomplished in the same manner as orchidectomy, with removal of the vas up to the external abdominal ring (v. p. 840). The scrotal wound is closed up to the exit of a temporary drain.

Comments.—When it is found possible, after freeing and ligating the ampullar end of the vas through the perineal wound, to free the rest of the pelvic portion of the vas by means of a finger introduced through the internal abdominal ring, after laying open the inguinal canal, and without extending the incision from the internal ring through the abdominal wall, toward the semilunar line, this should, of course, be done – and experience shows that this is sometimes accomplishable.

Instead of carrying an incision from the internal ring toward the umbilicus, sometimes the original incision, made parallel with Poupart's ligament, is extended beyond the internal ring, to the anterior superior iliac spine – separating the fibers of the external oblique, but cutting the fibers of the in-

ternal oblique and transversalis – but offers no advantage over the procedure described.

Another form of exposure, worked out by Young, consists in a median abdominal incision, from the suprapubic region to the umbilicus, to the upper end of which a transverse incision is added (constituting a T-shaped incision) dividing both recti muscles. This gives, upon retraction, a very broad exposure for the retrovesical dissection of the seminal vesicles and vasa deferentia on both sides – which may rarely be necessary. The peritoneum is not opened – but is recognized as the abdominal wall is divided and retracted, being stripped from the abdominal flaps, bladder, and pelvic wall.

PUNCTURE OF THE EPIDIDYMIS—AND EPIDIDYMOTOMY

Description.—Puncture, or incision of the epididymis is sometimes called for in acutely infective epididymitis, which is usually gonorrheal in origin – following exposure of the organ. Multiple punctures of an inflamed and distended epididymis will often give relief. Where pus is present in any quantity incision is indicated. The greatest care is necessary in order to avoid dividing the secretory duct of the testis.

Operation.—An incision from 5 to 8 cm. (2–3⅛ inches) is made over the lateral aspect of the scrotum – overlying the course of the cord and the junction of the epididymis and testicle. The cut is deepened down to the tunica vaginalis – which is incised over the junction of the epididymis and testicle. The tunica often contains serous fluid which has accumulated in connection with the primary pathology of the case – and this escapes when its wall is incised. This incision will admit of the more thorough visual and digital examination of the epididymis and testicle through the wound – which is made more thorough still by delivering the testicle and its swollen epididymis out through the incised tunica vaginalis, upon a warm, wet towel, ready to receive them. The necessary examination and manipulation is thus made much more satisfactory.

Puncture of the epididymis in one or more places – in the manner to be described worked out by Hagner – is, where it will suffice, preferable to incision – as it avoids any risk of severing the seminal duct, and even damages the seminiferous tubules less. With a very fine, straight bistoury, such as used in ophthalmologic operations (a Graefe knife, for instance), the areas of the epididymis which appear, and feel as though they contained abscesses (for acute infective epididymitis is usually a process of mutiple small abscesses) is carefully punctured – the puncture, however, only passing through the parietal layer of the tunica vaginalis and the sheath of the epididymis – after which a blunt-pointed probe is carried in through the small puncture wound, and, by blunt dissection, works its way into the focus of infection or pus – thus allowing an escape of the fluid along the side of and in the tract of the withdrawn probe – without dividing seminiferous tubules to any appreciable extent. Serum of a simply distended epididymis, or pus from an infected one, will ooze out of these minute incisions and blunt dissection always affording relief of pain and, usually, radical relief of the condition. If the punctures were carried deeper there would be considerable likelihood of cutting the coiled-up tube of the epididymis, which it may be difficult to avoid. Finally, the testicle is returned within the tunica vaginalis, which is partly sutured, and temporary drainage (which is usually maintained for two or three days) is provided for by a miniature cigarette drain, of a whiff of gauze included in rubber tissue, introduced between the epididymis and the tunica vaginalis, and brought out through the scrotal wound, which is sutured up to its exit

_ the suturing being accomplished, in Hagner's technic, by a subcutaneous stitch of silver wire.

Incision of the epididymis should be reserved for well-defined abscess cavities within its substance _ after such presence has been demonstrated by simple puncture (in the manner described above). When a puncture and the following blunt dissection with a probe have shown that a distinct abscess is present _ especially if containing more than a drop or two of pus, which is usually evacuable through the simple puncture, then a fine grooved director should be carried down through the opening made by the above technic, into the focus of pus _ and, with the director so disposed as to minimize the danger of wounding the seminal duct, or even a large number of seminiferous tubules, a narrow, straight bistoury is carried down the groove of the director, limitedly incising the pus cavity, but making an opening sufficient for drainage. Such cavities are, after being laid open, usually irrigated with the cut off end of a very small rubber catheter, attached to the nozzle of a small syringe _ through which Cabot recommends the throwing of a 1 : 1000 bichlorid of mercury solution, to be followed by normal saline solution. In concluding the operation a small cigarette drain is carried down to the surface of the incision into the epididymis, through the cavity of the tunica vaginalis, and out through the scrotal wound, which is sutured up to its exit. In all of these operative procedures for the relief of epididymitis the patient should remain in bed at least a week.

EPIDIDYMECTOMY

Description.—The excision of the epididymis is most frequently performed for local tuberculosis _ and the removal of this structure, along with the excision of areas of moderate tubercular involvement of the testis proper, have largely replaced the former more or less wholesale sacrifice of the testicle by total excision of testis, epididymis, and vas. There still remain cases, of course, in which this latter more radical measure has to be employed _ but certainly conservatism now points to the desirability of preserving as much of the sexual tract as feasible _ and accomplished facts demonstrate its possibility. As long as the blood and nerve supply of the testicle, and its internal secretion are preserved, although the continuity of its seminal duct be interrupted, the patient is a long way ahead _ especially if, later, the opposite testicle become involved. And provision is often possible for the re-establishment of the more specialized sexual functions of the gland _ through the bringing about of various types of anastomosis between the remaining parts of the spermatozoa-making and spermatozoa-conducting tracts, as will be described below.

To summarize _ it is often possible to remove limited tubercular, and possibly limited malignant foci, of the intrascrotal genital tract without depriving the individual of the internal secretion of that side _ or even the sexual secretion.

Reference has already been made, under exploratory orchidotomy (v. p. 825), as to how it is sometimes possible to excise, or curet intratesticular foci of tuberculosis without excising the whole testicle. It may, therefore, be said that a wise part of the complete technic, in excising the epididymis, is also to bisect the testicle exploratorily, and, if foci of disease be found within, to excise or curet them.

Operation.—An axial incision is made over the lateral or posterolateral aspect of the scrotum (the epididymis lying posterior to the testis) _ of from 5 to 7.5 cm. (2–3 inches) in length. Some Surgeons place the incision of approach more anteriorly. If any coexisting sinus be present, the single incision diverges into an ellipse which will include it. The incision is deepened _ the

tunica vaginalis is exposed and incised _ and the testis and epididymis are delivered from the tunic _ and, for greater convenience of manipulation, brought outside of the scrotal wound. The epididymis is now freed from the testis, to which it is bound by a reflection of the tunica vaginalis, and by the superior and inferior ligaments of the epididymis, as well as by its vascular connections. In this freeing which is best accomplished by delicate, curved scissors, care is exercised to avoid cutting the branch of the spermatic artery which is the important supply of the testicle, and which reaches the testis at its supero-internal aspect, between the epididymis and the testicle. The division of the reflected tunica vaginalis is begun at the tail of the epididymis, upon its inner and outer aspects, until the structure is freed from the body



Fig. 5147.—Epididymectomy; _ The testicle is exposed _ the tunica vaginalis incised, a, a _ and the testicle, b, delivered through the opening in the tunica as far as necessary. Scissors are in the act of detaching the body of the epididymis, e, from the testicle, c _ leaving more or less of the extreme head and tail intact after the excision of the body between the ligatures c and d.

of the testis _ the technic being made easier by grasping the fibrous covering of the epididymis with forceps, or a hemostat, and drawing it away from the testis, while the scissors divide its connections as close to the epididymis as possible (Fig. 5147) _ so that the edges of the testicular tunic will be left ample enough to be sutured together over the resulting raw bed. This method of mobilization of the epididymis is continued upward from its tail to its head (at which end the vascular connections are more intimate and more important) _ being everywhere freed from the testicle by a combined process of dissection and peeling.

When the structure of the epididymis is entirely mobilized the subsequent course must be decided upon before further steps. If no attempt is to be made to carry out any method of anastomosis, then both the proximal (head) and

distal (tail) ends of the epididymis are tied off with fine chromic catgut, and the epididymis between the ligatures excised _ free margins of the divided reflection of tunica vaginalis are sutured together over the bed of the excised epididymis (v. Fig. 5147) _ the testicle is replaced within the tunica vaginalis, which is closed by suture, with or without drainage, as indicated _ and the scrotal wound closed (up to the exit of the drain if any).

If, on the other hand, some form of anastomisis be intended _ and it is always desirable where feasible _ such as anastomosis of the vas with the testicle, or with the stump of the epididymis _ then steps to that end are taken as covered in the following description:

As a part of the technic it is often indicated to examine the interior of the testis (v. s.) _ to see if other foci of disease are present within it _ and, to accomplish this, the technic of exploratory bisection (described at p. 825) should be carried out. In those cases in which bisection is carried out in conjunction with anastomosis of the vas with the testicle, the axial incision of the posterior aspect of the testis for about one-third or one-half of its thickness is probably better than to bisect the anterior half of the organ, hinging the halves backward (as described in the technic to which the above reference is made).

Comments.—It is sometimes indicated to remove the vas deferens, up to the inguinal canal, along with the epididymis.

Epididymectomy is to be chosen rather than orchidectomy in cases where the testis is not extensively or seriously involved.

The best way of avoiding the important vessels of the parts _ which make their entrance and exit in the retracting angle between the two, at their postero-internal aspect, is to begin the separation of the epididymis from the testicle from the antero-external aspect of the structures.

It is sometimes found more convenient to begin the separation of the epididymis from the head rather than from the tail _ as well as from within outward rather than the reverse.

ANASTOMOSES BETWEEN VARIOUS PORTIONS OF THE INTRASCROTAL SEMINAL TRACT, FOLLOWING OPERATIVE INTERRUPTION, OR PATHOLOGIC OBSTRUCTION OF THE TRACT, CHIEFLY EPIDIDYMAL

The importance to the individual of both the seminal secretion and the internal secretion of the testes is self-evident. Even though the conducting tracts are interrupted, if the testes be well supplied with blood and innervation, their internal secretion is saved to the man. If, however, the conducting tracts are broken by disease or by operation, the sexual secretion on that side is lost to him _ unless some method of anastomosis of the parts of the tract is effected _ whereby either the impediment is short-circuited or the severed parts are connected up with each other.

Sterility of the testes, as to ability to transmit spermatozoa along the secretory duct of the testis, owing to its interruption by operation or pathologic occlusion by disease, may often be overcome by anastomoses of portions of the tract.

To these ends, various ingenious technics have been successfully worked out _ and undoubtedly others will be evolved. Some of those in present usage, following operations or conditions involving the epididymis, will be given.

But before any method of anastomosis can be put into execution its conception must be first followed by reasonable demonstration that the tracts which it is proposed to anastomose are patulous in both directions beyond the sites of anastomosis _ otherwise the anastomosis is, of course, useless.

The patency of the tract for the transmission of spermatozoa from the site of anastomosis to the urethra must be shown – and also the power to transmit spermatozoa from the testis to the site of anastomosis.

Method of Determining the Patulousness of the Seminal Tract Under Investigation for Possible Occlusion by Disease (Martin).—This technic has been chiefly applied in cases where the question of anastomosis comes up in connection with obliteration or possible obliteration of the seminal duct as a result of inflammatory action associated with acute epididymitis.

The vas deferens is located, by digital manipulation, at the postero-internal aspect of the scrotum, and is brought and held near the surface of the skin, isolated, as well as possible, from other structures – and, while thus steadied,

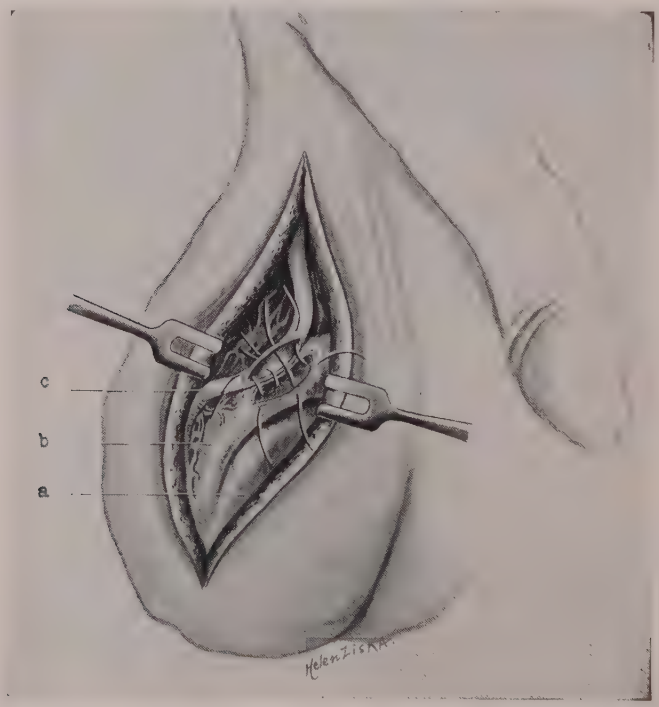


Fig. 5148.—Lateral Anastomosis Between the Vas Deferens and Epididymis: – a, Testicle; – b, epididymis; – c, vas deferens. Sutures are so placed as to be knotted outside of the lumen. The incised tunica vaginalis is not shown.

a curved needle is passed through the skin, in immediate proximity to the vas, under which it travels, and is made to emerge through the skin on the opposite side of the vas, immediately adjacent to the vas.

The seminal duct is thus steadied for exposure. The site chosen for its anchorage should be opposite the head of the epididymis. A soft-rubber catheter is passed into the bladder and anchored – or may have been passed as the first part of the technic. The scrotal skin and the structures overlying the vas are now incised over about 3.7 cm. ($1\frac{1}{2}$ inches) – and the vas exposed by careful dissection with knife and forceps, without finger manipulation of the parts, and without dividing vessels. The vas is limitedly incised, axially, with a fine, sharp knife – and, through the opening thus made, the blunt end of a needle, attached to a small syringe, is introduced into the lumen of the

vas, in the direction of the bladder, and about 2 c.c. (30 m.) of a colored, sterile solution is carefully injected – preventing the backflow of the slowly injected fluid along the side of the needle. The catheter is now watched – and the escape of colored fluid from the bladder demonstrates the patency of the vas, ampulla, and ejaculatory duct, from the site of the proposed anastomisis to the bladder – the ejaculatory duct emptying into the urethra so near the mouth of the bladder. (In view of the fact that patulousness may not be demonstrated, and, therefore, no use be made of the incised opening into the vas, it would seem better policy, when the vas is exposed, to introduce into it a sharp needle for the injection of the fluid, exactly as is done in securing blood from a vein

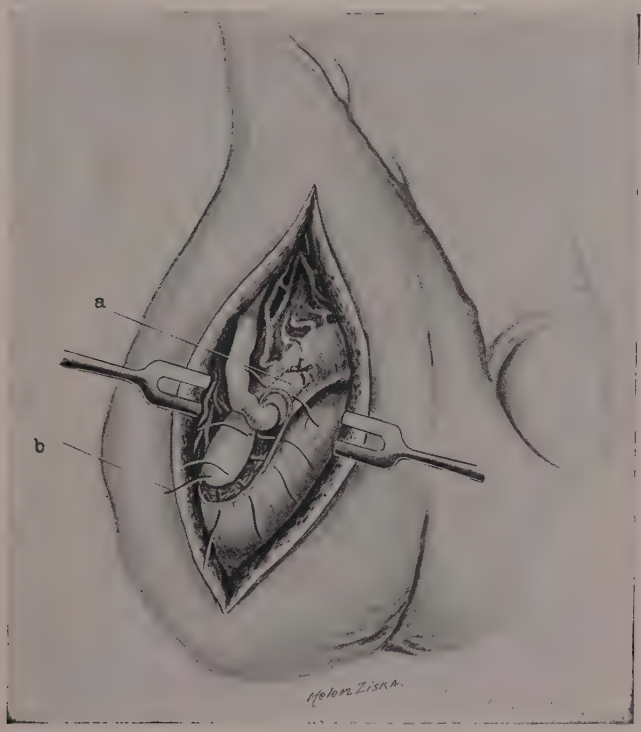


Fig. 5149.—Excision of the Tail of the Epididymis, Followed by Anastomosis Between the Proximal End of the Vas Deferens and the Distal End of the Epididymis; – The vas is anchored within the lumen of the epididymis by two sutures, **a.** The denuded bed of the excised portion of the epididymis is closed by sutures, **b.** The incised tunica vaginalis is not shown.

at the elbow, or as in infusing normal saline solution at the elbow – then, if indicated, the vas may be incised afterwards.)

If evidence of an obliteration of the lumen very near the site first tried be present, a second nearby site may be tried – and if areas of multiple obliteration be demonstrated, the anastomosis may have to be abandoned.

Next, it must be demonstrated that the epididymis, at the site at which it is proposed to make the anastomosis, is transmitting normal spermatozoa. At the selected portion of the epididymis, usually its head (or globus major) – which is exposed by a continuation of the original incision, and the necessary dissection – the epididymis is either seized with delicate forceps and a small elliptic piece of its wall cut out, or an incision by knife is made into it –

bearing relationship with the opening made into the vas. By carefully massaging the epididymis, in a direction from the testis, toward the incised opening, fluid is expressed _ which is collected upon a sterile microscopic slide, and immediately examined for living spermatozoa _ the presence of which will demonstrate the patulousness of the testicular side of the seminal tract. One or two additional areas of the epididymis may be similarly tested if the first area fail to produce positive proof of patency.

Lateral Anastomosis Between the Vas Deferens and the Epididymis (Lateral Vaso-epididymostomy), Following Obstruction of the Lumen of the Tail of the Epididymis, or Beginning of the Vas.—Patulousness of the entire seminal tract having been proved by the above technic, the steps of anastomosis are carried out (Fig. 5148). The vas and the epididymis are

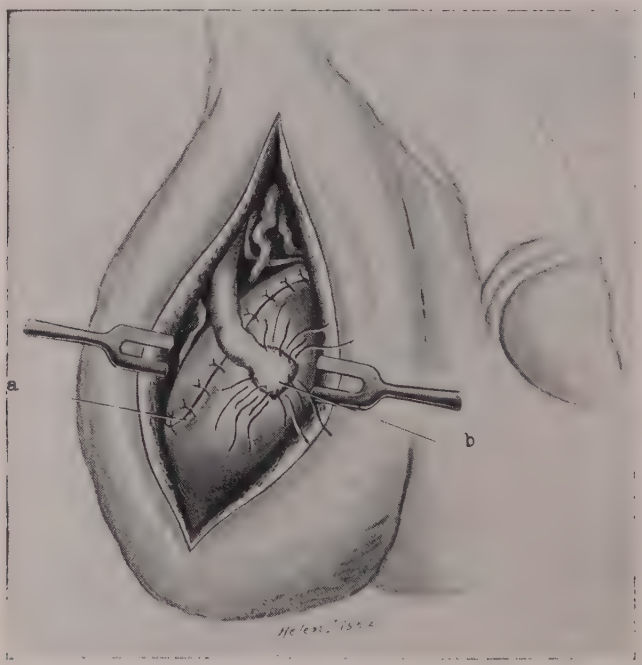


Fig. 5150.—Epididymectomy, with Anastomosis Between the End of the Vas Deferens and the Rete Testis: _ a, The bed of the epididymis is seen sutured; _ b, the split end of the vas is being sutured to a denuded area of testis, with lumen and rete in communication. The incised tunica vaginalis is not shown.

brought into relationship, side by side, through the incised tunica vaginalis so that the lips of the incisions originally made into each structure for exploratory purposes (to demonstrate patency and living spermatozoa) will now serve as the lips to be brought together in the anastomosis. Fine chromic catgut upon a small curved needle is used. The stitches are so placed as to be tied on the outer side of the structures after passing through the entire thickness of wall of both vas and epididymis _ as shown in the illustration. All of the sutures are placed before any are tied. Finally, the tunic of the cord and the tunica vaginalis are closed by buried catgut sutures _ and the scrotal wound is closed by silkworm filament, without drainage.

End-to-end Anastomosis Between the Vas Deferens and the Epididymis (End-to-end Vaso-epididymostomy), Following Partial Excision of

the Epididymis.—In cases where the tail of the epididymis, with more or less of the body of the epididymis, as well as the immediately adjacent portion of the vas, have been excised, an end-to-end anastomosis between the end of the divided vas and the end of the divided epididymis is often possible (Fig. 5149). The canal of the epididymis if too small in caliber to admit the end of the vas is carefully stretched with fine dilating forceps. Or the epididymal canal may be limitedly split instead _ or in addition. A straight needle, armed with fine chromic catgut, is carried through the wall, but not into the lumen of the end of the divided vas, and then, after drawing one limb of the suture through, another straight needle is threaded upon the opposite limb of the suture. These two needles are carried a short distance (between 5 and 10 mm., or 3/16–6/16 inch) into the canal of the divided epididymis, where

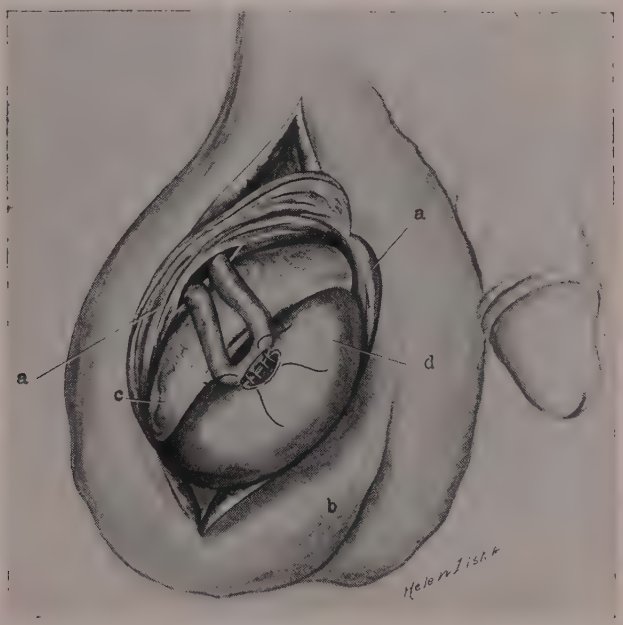


Fig. 5151.—Lateral Anastomosis of the Vas Deferens and Testis: _ a, a, Flap of split tunica vaginalis which has been raised to allow a loop of the vas to be drawn through. The loop of the vas is then incised _ and its lips sutured to the corresponding margins of a denudation upon the tunica albuginea, b; d, testis; c, globus major. The flap of the tunica vaginalis is then sutured into place _ and the scrotal wound closed throughout.

they are made to pierce the wall of the epididymis a little distance apart. By means of these, first used as a tractor and then as a suture, the vas is anchored, as shown in the picture. An additional catgut anchorage stitch may be placed at the free end of the epididymis. The raw bed, from which a portion of the epididymis has been excised, is now closed by suturing together with catgut the severed margins of the fibrous covering of the epididymis and testicle. Finally, the tunica vaginalis is closed _ and the scrotal wound _ with or without drainage, as indicated.

End-to-side Vaso-orchidostomy Following Total Epididymectomy.—The entire epididymis may be excised together with the testicular end of the vas _ leaving such a condition as may make it easier to perform an anastomosis between the end of the vas and the surface of the testicle than between

the end of the vas and the stump of the epididymis. The bed from which the epididymis was excised is closed by sutures (Fig. 5150) which bring together the margins of the fibrous covering of the testis. To give surface for anastomosis to the end of the vas it is limitedly split, so that the two little lips or flaps thus formed may be spread out. Over the selected surface of the testis a corresponding area of the rete testis is exposed by picking up the fibrous covering of the testicle with forceps and cutting it away with knife or curved scissors _ calculating that the split vas will just cover the denuded surface. The split end of the vas is then spread out and applied to the raw surface of the testicle _ and the margins of the split tube are then sutured to

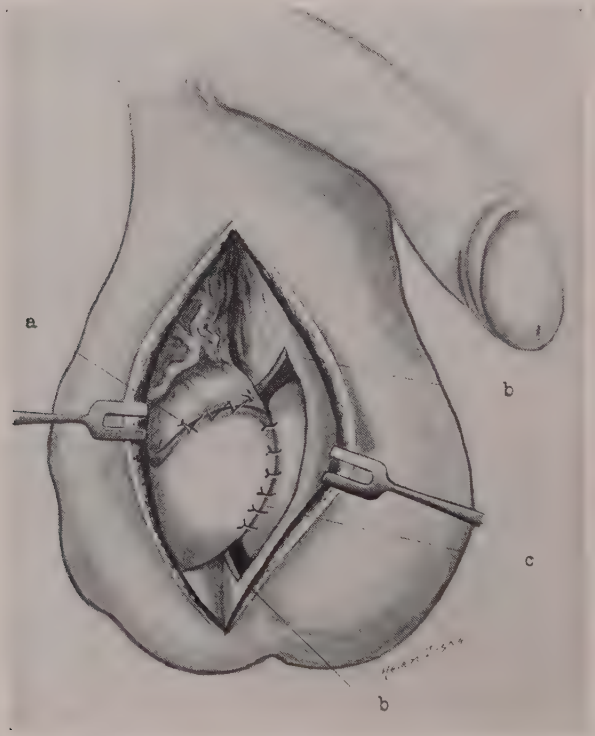


Fig. 5152.—Pascali's Operation for Intertesticular Anastomosis Following Unilateral Epididymectomy and Partial Vasectomy; _ Involved right testicle, upon which epididymectomy and epididymorrhaphy, **a**, following epididymectomy, have been performed. A window in the septum scroti, **b, b,** is seen, through which the operated testicle is shown sutured to the normal left testicle, **c**. The site of testicular anastomosis is made between surfaces by incision of their tunica albuginea, exposing the rete testis. The incised tunica vaginalis is not shown.

the margins of the denudation by means of fine chromic catgut sutures _ as shown in the above illustration _ thus bringing the spread-out lumen of the vas into contact with as much of the raw surface of the rete testis as possible. The tunica vaginalis and the scrotal wound are closed _ with or without drainage, as may seem better.

Lateral Vaso-orchidostomy in Occlusion of the Epididymis.—In cases in which such a test for patulousness of the tract as described above (v. p. 848) has proved occlusion of the epididymal tract, this portion of the seminal tract may be short-circuited by bringing a loop of the mobilized vas

deferens through a slit, or window, in the already incised tunica vaginalis _ where the incised loop may be anastomosed with the exposed rete testis _ in the manner illustrated in Fig. 5151. The denudation of the selected area of the testis is accomplished in same manner as described in the last operation. The fine chromic catgut sutures are, as far as possible, so placed as to be tied on the outside of the site of anastomosis _ which is always possible with the majority of the stitches, although one or two of the posterior set may have to be tied on the inside (as shown in the illustration). The incised tunica vaginalis and the incised scrotal tissues are closed as in the preceding methods.

Orchido-orchidostomy Following Excision of the Epididymis and Part of the Vas of One Testicle or the Occlusion of its Seminal Duct.— A testicle may be unable to deliver its spermatozoa to the seminal vesicle either because the epididymis and most or all of the vas of that side have been excised _ or because the seminal duct is occluded beyond repair (as by multiple areas of obliterated lumen). In such an instance the sexual function of the organ may be maintained by tunneling through the septum scroti partly by sharp and partly by blunt dissection _ and there bringing about an anastomosis between the opposite testicles _ by excising a corresponding area of the tunica albuginea on opposite surfaces of both testes _ the margins of which are then brought together by fine chromic catgut sutures _ thus bringing into contact the raw rete testis of each testicle (Fig. 5152). The excess of incision between the scrotal sacs is closed as well as the excess of incision of each tunica vaginalis _ after which the scrotal wound (which has been made over one testis only) is closed _ usually without drainage.

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